

**THE RELEVANCE OF NON-LEGAL TECHNICAL AND  
SCIENTIFIC CONCEPTS IN THE INTERPRETATION AND  
APPLICATION OF THE LAW OF THE SEA**

**AN ANALYSIS OF THE UNITED NATIONS CONVENTION ON THE LAW OF THE SEA**

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**2000**

(PhD UCT)

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74	MINING MANGANESE NODULES BY PUMPING THEM TO THE SURFACE FROM THE DEEP SEABED	ditto
75	SHIPBORNE SUCTION MINING SYSTEM	ditto
76	MINING USING A CONTINUOUS SYSTEM OF BUCKETS	ditto
77	LAND AND SHELF-LOCKED STATES	SAN HYDROGRAPHIC OFFICE
78	OCEANIC SYSTEMS	TIETJEN JH, <u>DICTIONARY OF MARINE SCIENCES</u> , (1988)
79	LANDBASED POLLUTION CYCLE	ALFRED WEGENER INSTITUTE <u>GLOBAL CHANGE: OUR WORLD IN TRANSITION</u> (1991)
80	ATMOSPHERIC POLLUTION CYCLE	ditto
81	THE ORGANIZATION DIAGRAM OF THE ISBA	BERNAERT A, <u>BERNAERT'S GUIDE TO THE LAW OF THE SEA: THE 1982 UNITED NATIONS CONVENTION</u> , (1988)

*FIGURE*

*CAPTION*

*SOURCE*

## TABLES

1	SOME ELLIPSOIDS ADOPTED FOR VARIOUS PORTIONS OF THE SURFACE OF THE EARTH.	TALOS MANUAL (SEE FIG 1)
2	ERROR TABLE OF OBSERVATIONS TAKEN USING "DGPS" IN THE SOUTH CHINA SEA	KAILONG L & JAIWEN W, 'HSD-001, Real DGPS Ocean Survey Location System', <i>IHR</i> VOL LXX (2) (1993)
3	MINERALS AND POTENTIAL SOURCES	ROSS (SEE FIG 18)

## LIST OF ABBREVIATIONS

AABW	Antarctic Bottom Water
AJIL	American Journal of International Law
BA	British Admiralty
BSR	Bottom Simulator Reflector
BYBIL	British Yearbook of International Law
CCAMLR	Convention on the Conservation of Antarctic Marine Living Resources
CCD	Carbonate Compensation Depth
CFC	Chlorofluorocarbon
CGM	Conference Generale des Poids et Mesures
CHM	Common Heritage of Mankind
CLC	International Convention Civil Liability for Oil Pollution Damage
CLCS	UN Commission on the Limits of the Continental Shelf
COB	Continent Ocean Boundary
DGPS	Differential Global Position System
DMO	Dipmoveout
DOALOS	UN Division of Ocean Affairs and Law of the Sea
DOP	Dilution of Precision
DS	Deep Water Hydrosweep System
EEZ	Exclusive Economic Zone
FAO	UN Food and Agriculture Organisation
GALOS	AIG Geodetic Aspects of the Law of the Sea Group
GATT	General Agreement on Tariffs and Trade
GEBCO	General Bathymetric Chart of the Oceans
GESAMP	Joint Group of Experts on the Scientific Aspects of Marine Pollution
GIC	General Instrument Corporation
GLORIA	Geological Long Range Inclined ASDIC
GPS	Global Positioning System
GRS	Geodetic Reference System
IALA	International Association of Lighthouse Authorities
ICJ	International Court of Justice
ICLQ	International and Comparative Law Quarterly
IHC	International Hydrographic Conference
IHO	International Hydrographic Organisation
IHR	International Hydrographic Review
ILM	International Legal Materials
IMCO	International Maritime Consultative Organisation
IMO	International Maritime Organisation
LNTS	League of Nations Treaty Series
IOC	UNESCO Intergovernmental Oceanographic Commission
IOPC	International Oil Pollution Compensation Fund
ISBA	UN International Seabed Authority
J Geophys R	Journal Of Geophysical Research
LAT	Lowest Astronomical Tide
LLD	Land Levelling Datum
LLW	Lowest Low Water
LW	Low Water
LWL	Low Water Line
LOP	Line of Position
LOSC	UN Convention on the Law of the Sea
MARPOL	UN International Convention for the Prevention of Pollution from Ships
MBSS	Multibeam Sonar System
MD	Medium Depth Hydrosweep System
MEY	Maximum Economic Yield

MSC	IMO Maritime Safety Committee
MSY	Maximum Sustainable Yield
MV	Motor Vessel
NADW	North Atlantic Deep Water
NAVAREA	Area Navigation Warning
NIEO	New International Economic Order
NIMA	US National Imagery and Mapping Agency
NOAA	US National Ocean and Atmospheric Administration
NTM	Notice to Mariners
OILPOL	Convention for the Prevention of Pollution of the Sea by Oil
PCB	Polychlorinated Biphenyl
PDR	Precision Depth Recorders
PREPCOM	UN Preparatory Commission
RV	Research Vessel
SANHO	South African Navy Hydrographic Office
SASS	Sonor Array Sounding System
SATS	South African Transport Service
SOEKOR	Southern Oil Exploration Corporation
SOLAS	UN Safety of Life at Sea Convention
SPLOS	UN Special Publication on Law of the Sea
TALOS	IHO Publication on Technical Aspects of the Law of the Sea
TIAS	US Treaties and Other International Acts Series
UNCLOS I	1958 UN Conference on the Law of the Sea
UNCLOS II	1960 UN Conference on the Law of the Sea
UNCLOS III	1973-1982 UN Conference on the Law of the Sea
UNEP	UN Environmental Programme
UNESCO	UN Education and Scientific Commission
UKTS	United Kingdom Treaty Series
UNTS	United Nations Treaty Series
USTS	United States Treaty Series
WGS	World Geodetic System
WHO	World Health Organisation

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# **PREFACE**

Of necessity LOSC Articles are brief and in some instances vague and requiring interpretation. There is general consensus that LOSC is successful and that its vagueness in certain areas is an asset allowing a variety of otherwise contrary attitudes to be accommodated.<sup>1</sup> It is necessary to analyse the Articles with a view to a better understanding of them and to possibly prepare for some future conference or convention that will more than likely be necessary to resolve some of the remaining problems. To illustrate the need for greater understanding of some of the Articles of LOSC the United Nations Office for Ocean Affairs and Law of the Sea found it necessary to convene a conference of 'experts' during 1993 and 1995 to consider the implications of the complex Articles of LOSC which deal with claims to the continental shelf. Criteria contained in Article 76 allowing for maximum outer limits of the continental shelf and other criteria to justify a claim are complicated and require experience in many fields including marine geology, geography, surveying, and geodesy.<sup>2</sup>

The intention is therefore to analyse the possible interpretation, application and consequences of the implementation of Articles in LOSC, and more particularly in a Southern African context. Provisions of LOSC, where technical and scientific considerations are crucial, will be selected for consideration. These include those involving geodetic, geographical, geological, survey, navigational, organisational, and social and resource factors. The effect of these factors on LOSC will be assessed and interpreted and any shortcomings found in the Articles will be highlighted and suggestions made for their possible improvement or interpretation. There will be thirteen chapters in four parts as follows:

## **PART I**

### **INTRODUCTION**

#### **CHAPTER I.**

##### **HISTORICAL DEVELOPMENT OF INTERNATIONAL LAW AND THE LAW OF THE SEA.**

The background to the Law of the Sea Convention will be given indicating the development of law of the sea and the historical and legal reasons for its establishment.

#### **CHAPTER II.**

##### **SOURCES OF MODERN INTERNATIONAL LAW.**

The sources and types of modern international law will be considered against a background of the law of the sea.

#### **CHAPTER III.**

##### **NEW IDEAS IN THE LAW OF THE SEA.**

New ideas in the law of the sea that have led to international conventions or to customary law will be discussed and the status of the relevant conventions noted.

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<sup>1</sup> Minutes of UN Meeting of Group of Experts on the Continental Shelf (11-14 September 1995) United Nations Document UN Ref.. SPWS/CLCS/INF (October 1995)

<sup>2</sup> *ibid*



## **PART II**

### **LOSC IN FUNCTIONAL PERSPECTIVE:**

#### **CHAPTER IV.**

##### **GEODESY**

Consideration will be given to the effects of geodetic factors on the Articles of LOSC.

#### **CHAPTER V**

##### **GEOGRAPHY**

Consideration will be given to the effect of geographical factors related to LOSC.

#### **CHAPTER VI**

##### **GEOLOGY**

The influence of geological factors on LOSC will be considered.

#### **CHAPTER VII**

##### **SURVEY.**

Survey methods used, the complications and errors that could result, and interpretations and omissions that may exist in data available for use in terms of LOSC will be considered. The effect of traditional methods of survey positioning and of the modern computerised systems will be evaluated against the requirements of LOSC.

## **PART III**

### **FUNCTIONAL APPLICATIONS IN LOSC**

#### **CHAPTER VIII**

##### **DELIMITATION AND QUESTIONS OF TITLE**

One of the major considerations of LOSC is the delimitation of both lateral boundaries and the outer limits of maritime zones. The various methods and criteria will be examined and the impact of the various physical factors referred to in Part II will be considered. Questions arising from delimitation or from the claims of States to title will also be examined.

#### **CHAPTER IX**

##### **NAVIGATIONAL QUESTIONS**

Consideration will be given to the implications of the Articles of LOSC for navigation, and methods of navigation, the control of vessels, and the rights, privileges and obligations of States involved in navigation.

#### **CHAPTER X.**

##### **RESOURCE CONSERVATION, EXPLORATION AND EXPLOITATION**

The implications of the Articles of LOSC in regard to the exploration, exploitation and conservation of marine resources will be considered in this Chapter. This will include threats to the resources, the

concept of the Common Heritage of Mankind and the rights of landlocked and geographically disadvantaged States.

## **CHAPTER XI**

### **POLLUTION AND THREATS TO THE ENVIRONMENT**

Aspects with an historical, economic or environmental threat, rights of communities, conservation, pollution, rights of access and traditional freedoms, implementation of some national legislation affecting internationally accepted activities will be considered.

## **CHAPTER XII**

### **ORGANISATIONAL STRUCTURES**

Organisational structures provided for in LOSC, the consequences of their implementation, the problems of effectiveness and the relationship with non-party States, and the possible effect on the rights and sovereignty of some States with particular interests will be analysed.

## **PART IV.**

## **CONCLUSIONS**

## **CHAPTER XIII**

### **CONCLUSION**

This Chapter will contain a summary of the relevant Articles in relation to the factors considered in the previous Chapters. A conclusion will be drawn on the relevancy and the effectiveness of LOSC and some recommendations on technical applications of LOSC will be made.

## **ANNEXURES**

### **ANNEXURE 1**

Table Relating Non-Legal Factors to the Articles of LOSC 3

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# PART I

## INTRODUCTION

### CHAPTER I

## HISTORICAL DEVELOPMENT OF INTERNATIONAL LAW AND THE LAW OF THE SEA

#### DEFINITION

*International law has been defined as those rules of international conduct, which have met general acceptance among the community of nations. It reflects and records those accommodations which over the centuries, States have found it in their interests to make. It rests upon common consent of civilised communities,<sup>3</sup> and*

*International law is the body of legal rules which apply between sovereign States and such other entities as have been granted international personality.<sup>4</sup>*

Shaw however sets international law in the wider context of international relations in general where he states;

*International law is clearly more than a set of rules. It is a culture in the broadest sense in that it constitutes a method of communicating claims, counter claims, expectations and anticipations as well as providing a framework for assessing and prioritising such demands.<sup>5</sup>*

#### THE NEED FOR INTERNATIONAL LAW

National or municipal law is enforceable in the sovereign territory of a State and the boundaries of the State are determined eventually by the general acceptance by other States of these boundaries. Territorial claims that are unacceptable to other States could result in these claims being contested by protest or confrontation.

An unacceptable unilateral claim to territory by a State would mean that the laws of that State would only be enforceable, on a citizen of that State in that area.

If the territory were in dispute the enforcement of national laws on citizens of another State that has not recognised the claimed sovereignty over the territory would be extremely difficult to achieve.

Since the earliest times communities have felt the need for a system of rules to regulate their inter-community relationships whatever their social structures were.

As the concept of independent States in Europe evolved a form of international law was necessary for them to co-exist. Early efforts were predominantly to establish boundaries, rights, and privileges by agreements and particular treaties. Agreements on land boundaries were relatively simple in principle as the agreements were usually confined to the States common to the boundaries. The sanction of other States was not normally required.

Gradually the practice of States became the foundation of international law. Unlike national or municipal law international law had no enforcement agency or body to rule, enforce or even arbitrate

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<sup>3</sup> D W Greig *International Law* (2<sup>nd</sup> Ed) (1976) p3

<sup>4</sup> G Schwarzenberg *Manual of International Law* (6<sup>th</sup> Ed) (1976) p3

<sup>5</sup> MN Shaw *International Law* (4<sup>th</sup> Ed) (1997) p53

on disputes between States. If circumstances were such that no agreement could be peacefully achieved it was possible that an arbiter might be agreed upon. In the final analysis if a State did not agree to arbitration or disagreed with the result, the prerogative to resort to violence to achieve an aim was a recourse that could be taken by a dissenting State. Mutual defence or protection treaties between States could involve other States in a dispute or conflagration. History records many instances of disputes between States escalating into major conflict. In July 1914, prior to the outbreak of the Great War, alliances existed between Serbia and Russia, Russia and France and Austria and Germany. A dispute between Austria and Serbia triggered off a war, which eventually involved all of these States. Great Britain had guaranteed the territorial integrity of Belgium and, as Germany attacked France through Belgium Britain also became embroiled in the conflict.<sup>6</sup>

## THE DEVELOPMENT OF STATEHOOD

The essential difference between Mediaeval States and Post-Reformation States was the ability of the governments of the Post-Reformation States, to control and enforce their own legislation within their own territory. This was a result of the centralisation of government in these States. It followed the transition from personal allegiance of a vassal to his monarch in mediaeval feudalism to allegiance through land tenure to a territorial monarch.<sup>7</sup> The territorial monarch had dominion over his State which could be regulated and governed by statesmen elected or appointed.

In the medieval State the Church did not confine itself to matters solely of a spiritual or theological nature and it exercised at least some powers over the citizens of the various States. These powers included the levying of taxes and the control of land. In these circumstances conflict between Church and State was inevitable. The rebellion of State against Church culminated in the Reformation and although in many areas of Europe Protestantism was rejected as a religion; the Church never recovered its power as a political force. In 1648 the Peace of Westphalia brought to an end thirty years of savage religious war and introduced a new political order into Europe.<sup>8</sup>

A danger existed that the development of statehood could have led to total individualism by the States. The expansion of trade to both the Far East and subsequently the Americas, the common cultural and intellectual interests resulting from the Renaissance, and the continuing religious sympathy of citizens of one State for those of another ensured however that efforts to co-exist continued. Lastly, in the aftermath of the savagery of the religious wars, opposition to violence as a solution for disputes increased. The climate was right therefore for the development of inter-State or international understanding and the rules to enable these States to co-exist if possible.<sup>9</sup>

Traditionally, for Statehood to exist, the following conditions were required;

- a) there must be territory. The boundaries need not be finalised but the territory must be of viable extent to allow habitation;
- b) the territory must be populated;
- c) there must be control over the population in the form of a government capable of conducting international relationships.<sup>10</sup>

The existence of Statehood is invariably not at issue in law of the sea questions but finalised boundaries and habitation are criteria critical to the determination of the claims to maritime zones by a State.

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<sup>6</sup> The Times History of the War Vol 1 (1914) p25

<sup>7</sup> J L Brierly The Law of Nations 6<sup>th</sup> Ed (1963) p1

<sup>8</sup> J R Green A Short History of the English People (1915) p635

<sup>9</sup> R P Anand Origin and Development of the Law of the Sea (1983) p4

<sup>10</sup> M Akehurst A Modern Introduction to International Law 6th Ed (1987) p52

## WESTERN INFLUENCE ON LAW OF THE SEA

It is accepted by most students of law that international law is occidental in origin.

*There is clear evidence of the lasting dependence of non-Western nations in the conduct of their international affairs upon fundamental concepts of the Western World from which their political leaders nevertheless so ardently crave to liberate their states without, however being able to derive any different workable principle of international law.<sup>11</sup>*

This statement was published in 1982, the same year as the adoption of LOSC, when it may have been thought that the interests of third world and landlocked States had been adequately addressed. It would appear that some Eastern and African States may view with suspicion the international law principles developed within cultures vastly different to their own. Since 1982 however, ninety-two African or Eastern States have made claims in terms of the Articles of LOSC. It would appear therefore that the international law of the sea might now have found greater favour with these States than other aspects of international law.

## SOVEREIGNTY

With the establishment of territory the 'doctrine of sovereignty' evolved. This was formulated in Jean Bodin's *De Republica* in 1576. Originally intended to mean the function of a sovereign as a legislator and as an essential principal of internal political order, sovereignty later became 'absolute power above the law'. What was intended as an attribute of a ruler became an attribute of the State.<sup>12</sup> The problem arises that the more that sovereignty is defined the more authority of sovereignty is placed within a State. Efforts to place sovereignty with the 'people' could be considered a form of totalitarianism with the power being with the majority. Minorities and individuals would be assigned rights at the will of the majority. Modern thinking is to regard the State as a 'juristic person':

*Still another modern development of the theory of sovereignty has been to give up the attempt to locate absolute power in any specific person or body within the state and to ascribe it to the state itself regarded as a juristic person.<sup>13</sup>*

But this also creates a problem in that;

*For if sovereignty means absolute power, and if states are sovereign in that sense, they cannot at the same time be subject to the law.<sup>14</sup>*

There must therefore be within a State some entity possessed of supreme political-legislative power.<sup>15</sup> There is little argument with this concept when regarding a State's internal situation, where it is hoped that there will be accountability to an electorate. Where overlapping claims to territory are made, two States who claim absolute power over the same area may have to concede that their absolute power, in this instance, is subject to laws over which they have no control and to the formulation of which they may have had no input. This is the essential dilemma of international law and is the kernel of the problem.

The first step that a State must take therefore should it wish to avail itself of international courts, tribunals or arbiters is to place its sovereign power subject to the authority of others.

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<sup>11</sup> Anand n9 p11

<sup>12</sup> Brierly n7 p4

<sup>13</sup> *ibid* p15

<sup>14</sup> *ibid* p16

<sup>15</sup> *ibid* p15

## EARLY PUBLICISTS

During the 16th and 17th century writers favoured 'natural law' and claimed that it was based on a long and continuous history extending back to the political thinking of the Greeks. This law derived from classical writings, scripture and dissertations on reason. Roman Law was largely ignored and State practice played little part in the development of international law at that time.<sup>16</sup>

A number of renowned Spanish priests made early contributions to the idea of international law. The foremost of these was Francisco de Vitoria who was Professor of Theology at Salamanca from 1526 until 1546. His lectures, *Reflectiones De Indis* and *De Juri Belli Hesperiorum in Barbaros* were published posthumously. These lectures dealt with the title of the Spaniards to exercise dominion over the New World. They were not a justification of Spanish actions in the Americas and were remarkable in the defence of the rights of the native inhabitants.<sup>17</sup>

Gentilis (Alberico Gentili) an Italian Protestant, who was a Professor of Civil Law at Oxford, has been partially neglected by historians and his *De Jure Belli* of 1598 is not quite as well known as the work of his more renowned successor, Grotius, who did however record his indebtedness to Gentilis. Gentilis was one of the first to separate international law from the Church's sphere of theology and ethics.<sup>18</sup>

In 1608 Hugo De Groot (Grotius) published, anonymously, his *Mare Liberum Sive de Jure Quod Batavis Competit ad Indicana Commercia Dissertatio* which propounded the concept of the freedom of the seas. This was an opinion prepared for the Dutch East India Company who were experiencing serious trade restrictions as a result of the Treaty of Tordesillas. In the Treaty, the Pope designated vast preferential trade areas to Spain and Portugal.<sup>19</sup> It was subsequently found that *Mare Liberum* was Chapter XII of his *De Jure Praedae*. It is understandable therefore that Grotius' opinions should advocate freedom of the seas. It can be accepted that this Treaty was excessive even by the standards of the 17th century.

While Grotius' *De Jure Praedae* and his *De Jure Belli ac Pacis* resulted in him being regarded by later generations as the father of international law it should be remembered that *De Jure Praedae* was written in support of a claim by the Dutch East India Company to a Portuguese vessel taken as a prize.<sup>20</sup> While *Mare Liberum* is regarded as a giant step in the early thinking of international law, *De Jure Praedae* was only discovered in 1864. With the exception of his concept of freedom of the seas some of his other arguments have not been adopted in international law. To disregard other early jurists and writers would be a disservice.

Although 'natural law' prevailed into the 18th century, Cornelius Van Bynkershoek, a Dutch jurist, was an early proponent of the idea of 'positivism' in an effort to relate international law to the practice of States. He advocated the 'Cannon Shot Rule' to define the extent of offshore sovereignty as being the limit of the range of shore based cannon. This realistic approach gave a practical solution to the problem of the extent of the territorial seas. Natural law had disappeared almost entirely by the beginning of the 19th century but the concept of the freedom of the seas had become entrenched in the principles of international law.

The main concern of the early communities would have been for their territorial integrity and to ensure that, if they were a smaller community, larger communities did not annex their territory or impose their will on them. States subsequently considered what actions would constitute unlawful or lawful use of war or violence and whether war was ever really justified.

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<sup>16</sup> Akehurst n10 p14

<sup>17</sup> Shaw n5 p21, Brierly n7 p26

<sup>18</sup> RR Churchill & AV Lowe *The Law of the Sea* 2nd Ed (1988) p3

<sup>19</sup> TMC Asser Institute *International Law and the Grotian Heritage* (1983) p 274

<sup>20</sup> Churchill n18 p3

Grotius stated :

*...it is so far from being right to admit as some imagine that in war all rights cease, that war ought never to be undertaken except to obtain a right: nor, when, undertaken ought it to be carried on except within the bounds of right and good faith. Between enemies those laws which nature dictates or the consent of nations institutes, are binding.*<sup>21</sup>

Richard Zouche, Professor of Civil Law at Oxford and a judge of the Court of Admiralty published the first manual on international law in 1650.<sup>22</sup> Zouche distinguished between a law of war and a law of peace and highlighted the fact that war was an abnormal relationship between States. Eventually the differences between lawful and unlawful war were disregarded and no distinction was drawn until the 20th Century.

Van Bynkershoek's most important works were *De Dominio Maris* 1702 and *Quaestiones Juris Publici* published in 1737. As a 'positivist', who based his arguments on custom justified by reason, '*ratio juris gentium magistra*' he held that the recent practice of States was more important than ancient tenets. This argument is valid when the growth of customary law is considered.<sup>23</sup>

Naturalist writers such as the highly esteemed Samuel Puffendorf, Professor at Heidelberg (1632-1694), Emerich de Vattel, a Swiss on diplomatic service in Saxony (1714-1769) and the German C Wolff (1679-1754) are noted but not considered further because of the disappearance of natural law as an influence on international law in the 19th Century and the first half of the 20th Century.

Oceans, seas, lakes and rivers have traditionally been used by man as a source of food, a means of travel or as a safeguard from intruders. For centuries nations have attempted to exert some form of control over these waters and their resources. Where other States border the same stretch of water, or where vessels of other States traverse the area or exploit the resources, the concern of the Coastal State deepens. As a result international law of the sea practices developed. Clashes of interest between States gave rise to treaties and arbitration in order to attain some form of peaceful co-existence. The practice of States expanded in the field of the law of the sea and as these practices became generally accepted they were regarded as representing customary law.<sup>24</sup>

#### LEAGUE OF NATIONS CONFERENCE: THE HAGUE 1930

In 1930 the League of Nations convened a conference in The Hague to consider international law subjects that had been submitted for possible codification. One of these subjects was the territorial sea. The Draft Convention on the territorial sea was rejected by the Conference due to disagreement amongst the attending States over the breadth of the territorial sea. Even though the Draft Convention was rejected, the articles therein were used as a base for future conferences on law of the sea.<sup>25</sup>

#### UNITED NATIONS CONFERENCES: GENEVA 1958 AND 1960

The United Nations Conference (UNCLOS I) was held in Geneva in 1958. Eighty-six States attended the Conference and the majority of these States became parties to at least three of the four conventions drafted at the Conference. These Conventions dealt with territorial waters and the contiguous zone, the high seas, fishing and conservation of living resources on the high seas and the continental shelf.<sup>26</sup>

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<sup>21</sup> Brierly n7 p31

<sup>22</sup> ibid p35

<sup>23</sup> ibid p36, Shaw n5 p105-110

<sup>24</sup> Z J Slouka *International Custom and the Continental Shelf* (1968) p1

<sup>25</sup> Churchill n18 p10

<sup>26</sup> 1958 Convention on the Territorial Sea and the Contiguous Zone.- 46 ratifications (1964).- 1958 Convention on the High Seas.- 57 ratifications (1962).- 1958 Convention on Fishing and Conservation of the Living Resources of the High Seas.- 36 ratifications (1966)- 1958 Convention on the Continental Shelf.-54 ratifications, (1964).



Although the breadth of the territorial sea was not finally agreed upon, the Conventions on the Territorial Waters and the Contiguous Zone, the High Seas and the Continental Shelf were regarded as successful as a codification of State practice and customary law. The Convention on Fishing and Conservation of the Living Resources of the High Seas contained innovative proposals however and that was probably the reason for the lack of support.<sup>27</sup>

In 1960 the United Nations held a further conference (UNCLOS II) to resolve the issue of the breadth of the territorial sea and the extent of fishing limits. Sixty States attended but regrettably no agreement could be reached on a compromise formula of a six mile territorial sea plus a further six mile fishing zone. The proposal failed by one vote. The concerns regarding aspects of the 1958 Conventions and other developments in the law of the sea practised were therefore unresolved.<sup>28</sup>

Technological advances made it possible for highly industrialised States to extend their exploitation of the High Seas and the deep sea bed to such an extent that lesser developed nations regarded their position as untenable.

Emerging States felt that they had not been involved in the drafting of the 1958 Convention and they, and in particular landlocked States, were concerned that the benefit of the exploitation of deep seabed resources would be denied them. These States are generally referred to as 'The Group of 77' although they now number more than 120. The threat of the destruction of the environment by over exploitation or pollution was also of great concern.<sup>29</sup> The concept of the 'The Common Heritage of Mankind' began to attract considerable support as it dealt with the legal status of the resources of 'common space areas' such as the deep ocean floor, outer space, the moon and Antarctica. This concept advocated that these resources should be for the benefit of all mankind.<sup>30</sup> These concerns gave rise to general support that another conference was necessary to review the whole law of the sea.

#### **UNITED NATIONS CONFERENCE:(UNCLOS III) 1973-1982**

In 1970 UN General Assembly, Session XXII passed Resolution 2570 convening the United Nations Conference on the Law of the Sea (UNCLOS III).<sup>31</sup> The Conference started in 1973 with three committees addressing the legal regime of the deep ocean floor, the territorial sea, contiguous zone, the exclusive economic zone, the continental shelf, the high seas, high seas fishing, living resources, straits and archipelagic States. A negotiation process of consensus was developed and used successfully by committees 2 and 3.

This enabled these two committees to establish consensus by constant reference to the Conference until a final draft was acceptable.<sup>32</sup> The Committee dealing with the legal regime of the deep seabed was politically motivated and endeavoured to force through Articles that were unacceptable to the majority of the major industrial nations. The ratification of the Law of the Sea Convention (LOSC) by most of the States who signed at Montego Bay, Jamaica, in 1982 was thought at the time to be therefore unlikely.

Ratification by the required sixty States to bring LOSC into force occurred during 1994. On 16 November 1993 Guyana became the sixtieth State to ratify LOSC and it thus came into force on 16 November 1994. The Convention binds only those States, which have ratified it, and until recently this was unlikely to include the major industrial or maritime States.

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<sup>27</sup> *ibid* pxxi, 14

<sup>28</sup> *ibid* p60

<sup>29</sup> *ibid* p16

<sup>30</sup> C J Joyner "Legal Implications of the Concept of the Common Heritage of Mankind" *ICLQ* Vol 35 (1986) p190

<sup>31</sup> Churchill n18 p14

<sup>32</sup> *ibid* 32

On 29 July 1994, at a resumed session of the UN General Assembly, Agenda Item 36 : Law of the Sea, was adopted. Resolution (48/263), The Agreement Relating to the Implementation of Part XI, was carried by 121 votes in favour to none against with seven abstentions which included the Russian Federation. A detailed analysis of the Agreement and its effect on LOSC will be considered in the chapter dealing with the exploitation of marine resources. This Agreement does however appear to remove the main obstacles to acceptance of LOSC by the majority of the major industrialised States.

Many of the Articles of LOSC were widely in use as State practice prior to the Conference. Some were put into practice during the Conference as a result of the Conference Committees highlighting future possible State practice that would be internationally acceptable.<sup>33</sup> These Articles are considered now to have become customary law. The major States will have the benefit of these Articles whether they ratify LOSC or not.

LOSC endeavours to address all aspects of the law of the sea including delimitation and delineation of maritime boundaries and zones, the establishment of the various maritime regimes, exploration and exploitation of marine resources and freedom of navigation. Organisational structures, historical aspects, economic and environmental threats, rights of communities, conservation, pollution, traditional freedoms and internationally accepted social activities are also addressed in LOSC. The Convention is the subject of this analysis.

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<sup>33</sup> Akehurst n10 p169

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## CHAPTER II

### SOURCES OF MODERN INTERNATIONAL LAW

Modern sources of international law are both legal and literary. The literary source is not a process of creating law but more a description of law.

#### LEGAL SOURCES

There are four legal sources of international law;

- a) Treaties and Customs;
- b) Decisions of Courts: In accordance with Article 38(1)(d) of the Statute of the International Court of Justice the Court (ICJ) is directed to apply judicial decision as a subsidiary means for the determination of rules of international law;
- c) Teachings of Highly Qualified Publicists (Legal Writings and Academic Teachings);
- d) General Principles of Law Recognised by Civilised Nations (Article 38, Statute of ICJ).

Article 38(1)(d) directs the Court to apply the teachings of the most highly qualified publicists of the various nations as a subsidiary means for the determination of the rules of international law. The General Principles of Law are, however, not of great importance.

#### Treaties

The 1969 Vienna Convention on the Law of Treaties, in force since 27 January 1980, defines a treaty as

*An international agreement concluded between States in written form and governed by international law, whether embodied in a single instrument or in two or more related instruments and whatever its particular designation.*<sup>34</sup>

The law of treaties concerns the question of the content of obligation between individual States: the incidence of obligation in *personam*.<sup>35</sup>

An important aspect is the special relationship of a State party to a treaty with a State that is not party to a treaty. A treaty does not confer any rights or obligations on a State that is not a party to a treaty except in terms of Article 35 of the Vienna Treaty Convention.

An obligation arises for a third state from a provision of a treaty if the parties to the treaty intend the provision to be the means of establishing the obligation and the third state expressly accepts that obligation in writing.<sup>36</sup>

<sup>34</sup> Convention on the Law of Treaties (1969) Vienna Article 2(1)(a), Shaw n5 p74, 110-114

<sup>35</sup> I Brownlie Principles of Public International Law (5thEd) (1998) p11-13

<sup>36</sup> Akehurst n10 p32

Treaties to which only a few States are parties are regarded as particular treaties when compared with other treaties and conventions that may have arisen from international conferences although there is no fundamental difference.<sup>37</sup>

Treaties are binding on the States party to the treaty. They often codify customary law as it is practised at the time of drafting. Sometimes, however, innovative aspects are included which are peculiar to that treaty or convention.

Treaties or conventions are necessary where there is no acceptable legal practice of States that deals with the problem or where particular circumstances require special consideration.

Not all treaties are law making. Some may have been entered into for reasons of a fiscal, personal or material nature. These treaties resemble contracts and some writers have drawn a distinction between these treaties and those that establish or codify law. It should be noted that this distinction between law-making and contractual treaties is only one of content and it may also be possible to have treaties comprising both aspects.<sup>38</sup>

As more and more treaties are entered into, the greater is their influence as a source of international law. The official list of treaties entered into by the United Kingdom, as reflected in the United Kingdom Treaty Series, comprised 190 pages in 1892. By 1960 this had grown to over 2500 pages.<sup>39</sup> Treaties have begun to assume a greater role in the development of international law than customary State practices.

States now accept that there are basic principles of international law out of which States may not contract. They are

*peremptory norms of general international law (ius cogens).*<sup>40</sup>

### Customary Law

For international law to be considered customary a number of standard requirements must be met:

- a) concordant practice of a number of States with reference to a type of situation falling within the domain of international relations;
- b) the continuation and repetition of the practice over a considerable period of time;
- c) the conception that the practice is required by, or consistent with, prevailing international law and;
- d) the general acquiescence in the practice by other States.<sup>41</sup>

Again this has been said that;

*almost all the doctrine on the subject is limited to the statement that international custom results from similar and repeated acts by States, repeated with the conscious conviction of the parties that they are acting in conformity with law.*

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<sup>37</sup> ibid p130/131

<sup>38</sup> ibid p163

<sup>39</sup> ibid p39

<sup>40</sup> ibid p41/42

<sup>41</sup> Slouka n24 p1

*Thus there would be two factors in the formation of custom:*

- 1) *a material fact; the repetition of similar acts by States and*
- 2) *a psychological element usually called the 'opinio juris sive necessitatis'; the feeling on the part of the State that in the action they are fulfilling a legal obligation.*<sup>42</sup>

The psychological element includes not only what a State's practice is or how often it occurs but also why it occurs.<sup>43</sup> It is not enough however to prove that States very often acted in accordance with a rule. It should be shown that the States regarded the rule as obligatory and not a voluntary action on their part.

The requirement that the practice must have been in existence for a considerable time unfortunately attempts to quantify what is regarded as a dynamic process. There is also ambiguity in the idea of a considerable period of time. It has therefore been suggested that if a quantitative evaluation is done it should not be based on the number of States involved over a period of time but in the number of instances of State to State relationships involving the aspect under consideration.<sup>44</sup>

In the Anglo/Norwegian Fisheries Case<sup>45</sup> it was held that the British Government had not reacted to the proclamations of the Norwegian Government of a series of straight baselines around its deeply indented coastline establishing internal waters dating from 1812. This undermined their argument when they eventually contested these baselines before the Court in 1951.<sup>46</sup> Norway had issued a number of proclamations starting in 1812 with little reaction from other States except in 1869 by the French Government which sought clarification of a similar decree issued at that time. When the two decrees of 1935 and 1937 were issued the British Government challenged the legality of the baselines but they had difficulty explaining their acquiescence to the earlier decrees.<sup>47</sup>

Though the decisions of national courts are not international law precedents they may be evidence of State practice.

Customary law is international law accepted as State practice and Comity is State practice used when it is in a State's interests or when it is polite to do so. International comity *comitas gentium* is usually polite behaviour between States that includes neighbourliness, waivers of minor requirements, and goodwill. It endeavours to create a harmonious climate between States without being bound by the practice. Continuous practice by States, although undertaken as comity, could however become customary law.<sup>48</sup>

From 1948 until 1956, when it delivered its report to the UN, the International Law Commission, which comprised twenty-four international jurists (previously fifteen) was tasked with the codification of customary law. Its reports formed valuable documentation for subsequent conferences and were not attempts to circumvent or replace conventions, as they could not be binding on any State. They did however serve as valuable evidence of customary law at that time.<sup>49</sup>

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<sup>42</sup> I Kopelmanas "Custom as a Means of the Creation of International Law" 18 BYBIL Vol 1 (1930) p100

<sup>43</sup> Akehurst n10 p44

<sup>44</sup> Slouka n24 p2

<sup>45</sup> Anglo/Norwegian Fisheries Case (1951) ICJ Rep.116

<sup>46</sup> T Scovazzi et al Atlas of Straight Baselines 2nd Ed (1989) p183/184 Case (1951) ICJ Rep.116

<sup>47</sup> DP O'Connell The International Law of the Sea Vol 1 IA Shearer (ed) Vol 1 (1981) p36, Churchill n18 p29

<sup>48</sup> Brownlie n35 p5-8

<sup>49</sup> Akehurst n10 p33-34

## Doctrine of Persistent Opposition

Should a State wish to indicate clearly that it is opposed to a practice of another State, as in the Anglo/Norwegian Fisheries Case, it must indicate clearly that it has persistently and publicly opposed the practice and it is therefore not bound to comply should others regard the practice as customary.<sup>50</sup>

An offshoot of this is the concept of the 'Relatively Binding Rule' where a State does not agree with a particular State practice and will not participate itself in such practice, though the practice in question might find support in the practice of other States and be binding on them *inter se*.<sup>51</sup>

## International Court of Justice

Article 1 of the Statute of the International Court of Justice constitutes the Court as established by the Charter of the United Nations.

Article 38 indicates the accepted sources of international law. Brownlie questions whether it introduces a hierarchy of sources. While the Court may consider the sources listed, it may decide its own system of application. The litigants may request the Court to rule on matters in contention and thus be able, in this manner, to exert some influence indirectly on the Court as to what law should be considered and what the priority of the sources should be.

Customary law is regarded as a formal source but the judicial decisions of international tribunals, which are not regarded as formal sources, may in some instances be regarded as authoritative evidence of the state of law.

The terms of reference of the International Court of Justice and its predecessor, the Permanent Court of International Justice, created by the League of Nations in 1920, were to apply international law as it existed at the time and not to create it.<sup>52</sup> This effectively precluded the establishment of 'precedent' as a factor for subsequent adjudication. The Court has, on occasions however, referred to previous judgements. Where methods of delimitation or concepts such as 'natural prolongation' have been contentious issues in previous cases the court has endeavoured to maintain consistency in judgement. The Court however adheres to established court procedure.<sup>53</sup>

## Teachings of Highly Qualified Publicists (Legal Writings and Academic Teachings)

Legal writings and teachings are a very tenuous source of international law, as some publicists may promote national interests or prejudices or expound innovative ideas rather than assess the current position of international law. The views of publicists are highly regarded however and are often referred to in national courts. Brownlie feels that while publicists are not used by the International Court and do not appear in the judgements, this could be as a result of the selectivity of citations in a majority judgement. Separate or minority opinions tend to be less selective and could indicate the use of legal writings. Shaw feels however that academic writings stimulate thoughts about what the values and aims of international law should be pointing out the defects that exist and possible suggestions for the future.<sup>54</sup>

An area of international law that was thought to be open to dispute was the hierarchy of sources, where a rule derived from one source was in conflict with another rule from another source. There is a marked overlapping in sources however and a rule could derive from more than one source. It is unlikely therefore that rules derived from different sources should be in conflict with one another. The application of international rules and norms within the national legal systems of States can often vary considerably.

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<sup>50</sup> Shaw n5 p70, Brownlie n35 p10

<sup>51</sup> Akehurst n10 p129-130

<sup>52</sup> Brownlie n35 p19-20

<sup>53</sup> *ibid* p17, Shaw n5 p21-28

<sup>54</sup> *ibid* p22, Shaw n5 p89

## EARLY ATTEMPTS TO DEVELOP LAW OF THE SEA

The law of the sea is obviously an aspect of international law, but the sea has traditionally been a source of food and an unrestricted highway for many nations. The introduction of sovereignty over portions of the sea and the consequent reduction of the rights of others over them could result in confrontation. It is also impractical to permanently demarcate all areas of the seas or seabed.

The early Greek attitude to the exercising of rights over the seas was not specific and this attitude can be interpreted as exercising control over the seas when necessary, but not on a permanent basis. International trade was encouraged and the concept of the 'freedom of the seas' appears to have been supported.<sup>55</sup>

The earliest attempt to enforce some form of law of the sea appears to have been by the rulers of the island of Rhodes during the third century BC. Rhodes had been restored to independence by Alexander the Great and, as it was situated on the maritime crossroads between Egypt, Cyprus, the Syrian and Phoenician ports and the early Greek world, it was of great importance in the sphere of maritime trade. To ensure the continuance of this trade, the Rhodians attempted to protect the mariners from the pirates and brigands active in that area. As a result of these efforts this State eventually codified its maritime commercial practices into the Rhodian Sea Law.

The Roman Emperor Antoninus Pius is reputed to have said that:

*I am the lord of the world, but the law is the master of the sea. Let thy pliant and controversy.....be decided by the law of the Rhodians.*<sup>56</sup>

The Rhodian Law formed the basis for many of the codes that were subsequently developed by coastal States to control vessels and their waters. A number of these are notable.

In the Mediterranean, in the 8th Century, Barcelona was a major maritime trading nation and a collection of the judgements of the magistrates of this port became known as the 'Consulate of the Sea.' England and the Netherlands abided by the code 'Judgement d'Oleron' named after an island in the Bay of Biscay where the accord was reached. In the Baltic the Laws of Wisby and Lubeck were observed, but by the 13th Century all of these had disappeared.<sup>57</sup>

From about the beginning of the 2nd century, the Romans had applied a doctrine of the common right of all men to free use of the sea, but this was only codified during the 6th century.<sup>58</sup> This was, however, intended for relationships between individuals in the same State and not between sovereign States. Although the Romans held dominion over the seas, as a result of superior navies, and the concept of freedom of the seas was a source of great concern to them, it did not receive much international attention.

Most of the disputes arose as a result of maritime nations endeavouring to ensure that either their maritime trade routes were protected or to ensure the security of the State through whose waters others were trading. With the marked exception of fishing, the resources of the sea and seabed were generally not factors in dispute at that stage.

It is now universally recognised that the high seas should be open to all and that no State should claim sovereignty over it. The legal origin of this doctrine is not clear and those who support the idea that the origins are to be found in Roman law may be categorised in two groups;

- a) the *res nullius* approach - The high seas belong to no-one;

<sup>55</sup> C Phillipson The International Law and Custom of Ancient Greece and Rome (1911) p376- 378

<sup>56</sup> Anand n9 p11

<sup>57</sup> *ibid* p10

<sup>58</sup> P B Potter The Freedom of the Seas in History Law and Politics (1994) p27-35



- b) the *res communis*(*res communis omnium naturali jure*) approach - The high seas belong to all.

This created problems as *res nullius*, meant that a thing could be owned. A *res communis*, where it was owned by all, could be partitioned.

These suggested origins do however indicate that while no one State may claim sovereignty over the high seas, the community of nations must be entitled to establish binding rules to prevent anarchy and lawlessness in areas where no State may exercise control. It was considered therefore that the right to ensure the freedom of the high seas was recognised as an international right of the community of nations.<sup>59</sup>

## EMERGENCE OF CLAIMS TO TERRITORIAL SEAS

During the 13th Century, due to lawlessness on the seas, some States had begun to exercise jurisdiction over the seas adjoining their coasts for the protection of navigators. It had become generally accepted that coastal States should exercise some authority over the waters and seas adjacent to them.

At that time Venice, which was the major Eastern Mediterranean trading nation and renowned for its wealth, influence and maritime power, laid claim to the entire Adriatic Sea although it did not have sovereignty over the shores on both sides. This was eventually accepted by the other States that bordered the Adriatic and mariners who were not Venetian that they were obliged to pay tribute to be able to traverse the sea. Failure to pay this tribute meant that passage by their vessels would have been prohibited.<sup>60</sup>

At the same time another major maritime State, Genoa, laid claim to the Ligurian Sea and these two States were later followed by other coastal Mediterranean States. Denmark, Sweden and Poland divided the Baltic amongst themselves.

The Nordic State's maritime claims led to many disputes and treaties over navigation, fishing and trading in northern European waters.<sup>61</sup>

The renowned Perugian jurist, who lived in the first half of the 14th Century, Bartolus of Saxo-Ferrato, declared that the authority of a coastal ruler extended to a hundred miles from the coast or two day's journey. In this area the ruler had the right to apprehend or punish any offender. A student of his, Baldus Waldis, also an Italian jurist, reduced this distance to sixty miles or one day's journey. It appears that this limit was related to the extent of the safe navigation of the period, where in later times this limit would be related to the range of a cannon.<sup>62</sup>

This concept reappeared in 1821 when a Russian *Ukase* (Proclamation) prohibited navigation in the Behring Sea within a hundred Italian miles of the coast.<sup>63</sup>

With the 1494 Treaty of Tordesillas and the Bulls *Inter Caetera* of 4 May 1493 and *Ea Quae* of 24 January, issued by Popes Alexander VI and Julius II, respectively,<sup>64</sup> Spain and Portugal were awarded exclusive rights to large portions of the earth, with the western part of the Atlantic going to Spain and the Indian Ocean to Portugal.<sup>65</sup>

<sup>59</sup> C J Colombos *The International Law of the Sea* 6th Ed (1972) p47-48

<sup>60</sup> T W Fulton *The Sovereignty of the Sea* (1911) p3

<sup>61</sup> *ibid* p4

<sup>62</sup> *ibid* p539/540

<sup>63</sup> *ibid* p541

<sup>64</sup> H van der Linden "Alexander VI and the Demarcation of the Maritime and Colonial Domains of Spain and Portugal 1493 - 1494" 22 *American Historical Review* (1916) p1

<sup>65</sup> Fulton n60 p5

This ridiculous division gave rise to Grotius' *Mare Liberum* which has been quoted as being the reason for the rise of opposition to this Treaty and to its demise. Fulton feels however that the success in having this Treaty nullified was largely due to the exploits of the Englishmen Drake, Hawkins, Cavendish and the Dutchman Jakob van Heemskerck. He feels that recognition should rather have been given to Queen Elizabeth, for asserting the right to freedom of the seas through the actions of her admirals, than to a Dutch jurist.<sup>66</sup> This opinion of Fulton could equally be regarded as biased in favour of the English efforts. This is a classic case of either the pen being mightier than the sword or *vice versa* and the verdict has not been given.

Grotius' arguments on the freedom of the seas are expressed in his Chapters 1 to 13 and state essentially that navigation is free to all, and that the Portuguese have no right to total sovereignty in the East Indies by discovery, occupation, prescription or custom. Further, the claim to the right is based solely on Papal donation and the Dutch should continue to insist on the right to trade by whatever means available.<sup>67</sup>

*The history of the law of the sea has been dominated by a central and persistent theme: the competition between the exercise of governmental authority over the sea and the idea of the freedom of the seas.*<sup>68</sup>

## THE ENGLISH SEA

England was a major coastal State, whose mariners, with those of most other trading nations of the time, were plagued by pirates and robbers, Greeks and Saracens in the Mediterranean, Scandinavians in the north and freebooters generally:

*the sea was then common only in the sense of being universally open to depredation.*<sup>69</sup>

The rise of the English Navy and the enormous claims made by England to the 'English Sea' is thought initially to have been made in the interests of peaceful trade.

The sovereignty that was claimed over the English Channel was not enforced to the extent that foreign warships required permission to traverse the area or that fishing was prohibited. This was the situation until the late 16th Century and although the requirement to lower the topsails or to strike an ensign to acknowledge English sovereignty when encountering an English man-of-war had been in existence since Tudor times, it was only with the succession of James I (reigned 1603-1624) that the precise outer limits of bays along the English coasts were determined. The closed bays or 'Kings Chambers' were fixed, to prevent acts of war or other hostile actions occurring close to the English coast as a result of the war between Spain and the United Provinces.

In 1609 James introduced a fishing prohibition along the British and Irish coasts and licences to fish in these areas were obligatory for foreigners. This prohibition was directed mainly at the Dutch whose herring fishing had financed much of their very successful trade and commerce.

Charles I (reigned 1624-1649) extended the English claim in the widest possible sense. The 'English Sea' now extended to the coast of the continent and all maritime activity in these seas was subject to the patronage of Charles. It had been contemplated that levies would be imposed on foreigners but the sheer magnitude of the task made this impossible. Fulton records:

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<sup>66</sup> ibid

<sup>67</sup> Grotius *Mare Liberum* Magoffin (Tr) (1916) p7-10, 22-44

<sup>68</sup> O'Connell n47p1

<sup>69</sup> Fulton n60 p5

*It is pitiful to read of the proceedings of the great ship-money fleets created under circumstances so memorable in English history, roaming about the Channel in their vain attempts to compel the French men-of-war to strike their flags and in the North Sea forcing the King's licences on poor Dutch herring fishermen.*<sup>70</sup>

## THE BREADTH OF TERRITORIAL SEAS

The English sovereignty claim lasted until at least 1784 when provision was made in a treaty entered into with the Dutch Republic for the traditional salute to be dispensed with. It is remarkable that at no stage during this lengthy period of English claims to the 'English Sea' was the extent of this claim clearly defined. The only vague attempt was by John Selden in 1635 in *Mare Clausum Seu de Dominio Maris, Libri Duo*.

He defined the 'English Sea' as

*that which flows between England and opposite shores and ports.*<sup>71</sup>

During the 17th Century Selden's influence, as a result of *Mare Clausum*, was relatively high in England, but Admiralty Reports indicate repeated requests for greater clarity as to the extent of the sovereignty over the sea as enforcement was constantly a problem.<sup>72</sup>

Grotius referred to

*...so much of the sea as might be seen from the shore.*<sup>73</sup>

as a method of determining the extent of the territorial seas. This was vague as the height of eye would have an enormous effect on the range as would visibility, which could easily be affected by weather conditions.

Van Bynkershoek's proposal of the 'Cannon Shot Rule' or '*terrae dominium finitur ubi finitur armorum vis*' which he was the first to expound as a means of defining the limit had become the accepted and practical solution to the control of adjacent waters. Grotius had previously in *De Jure Belli ac Paris* obliquely referred to this concept.

*when in regard to territory as when those who sail on the coasts of a country may be compelled from the land just as if they were on the land.*<sup>74</sup>

Sovereignty over territorial seas has been regarded as having derived from earlier claims by States to large portions of the oceans and seas. Both Denmark and Sweden were obliged to make concessions in relation to their previous claims. The territorial seas appertaining to these States appear, at the beginning of the 20<sup>th</sup> century, to be the remainder of their earlier claims after concessions were made. The claims of Great Britain to vast English Seas died out and vanished without leaving an international law right.<sup>75</sup> During the 18th century, the adoption of the 'Cannon Shot Rule' as the breadth of the territorial sea of a State gradually appeared in particular treaties or edicts.

Treaties were concluded between the United States of America (US) and Morocco (1785), Great Britain and France (1786), France and Russia (1787) and Spain and Tripoli (1784) and in 1803 Austria

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<sup>70</sup> ibid p11

<sup>71</sup> ibid p19 (J Selden *Mare Clausum* (1635) pii cxiii unavailable to me as primary source)

<sup>72</sup> ibid p20

<sup>73</sup> Grotius n67 p545

<sup>74</sup> Fulton n60 p 549

<sup>75</sup> ibid p538

also adopted it.<sup>76</sup> From the beginning of the 19th century, possibly as a result of the practice of both Great Britain and the US, three miles was adopted as the range of the weaponry and this distance eventually replaced the idea of the range of shore-based cannons. It should be noted that the miles referred to are usually nautical or marine miles. These are determined as a minute of latitude or 1852 metres (1.852 kilometres).

While the French applied the basic 'Cannon Shot' rule into the 20th Century, the Danes claimed extensive areas in the Norwegian Sea. In the face of opposition from the Dutch, French and English these claims were gradually reduced to one league (3 miles).

From 1598, when the Danes captured English vessels fishing within 'two Norwegian leagues' of the Westman Islands they attempted to control the northern seas as a form of *Mare Clausum*. They did this up to the middle of the 18th Century when they established a trade monopoly in Greenland. While there continued to be constant disputes with neighbouring States, it was only in 1691 that the Danes proclaimed a neutrality zone 'within sight of land' (4-5 leagues). The neutrality zone varied in width until 1818 and was partially dependent on political alliances, conflicts or agreements between adjoining States. Although the Treaty of 1818 between the US and Great Britain, provided for US fishing off the coasts of British Dominions, is reputed to have converted the cannon shot distance to three miles, Heinzen is of the opinion that the origin of the three-mile-limit concept can be found in the limits employed by the Scandinavian countries for over two centuries.<sup>77</sup>

In 1800 and 1801, Lord Stowell ruled in two cases involving the vessel, the *Twee Gebroeders*,<sup>78</sup> and in 1805 in a case involving the vessel *Anna*.<sup>79</sup> The vessels had been taken as prizes in waters close to Prussia and America, respectively. In passing judgement, Lord Stowell quoted both cannon-shot distance and three miles from the shore as the criteria for sovereignty. As a result of his judgement equating cannon shot and three miles in the first and third cases, it is claimed that the three-mile-limit originated in English law. This limit gradually gained general acceptance as the result of further judgements.<sup>80</sup>

An offence was committed on board an American vessel *Leda*<sup>81</sup> within one mile of the coast in Penarth Roads. Cockburn CJ held that by incorporating the two islands, The Holms, in the bay, the waters from the headlands via the islands should be regarded as inland waters.<sup>82</sup> This could be the first recorded instance of islands near the mouth of a bay being included in straight lines closing the bay for the purpose of determining internal waters.

In spite of the judgements of Lord Stowell the breadth of the territorial waters was not specified in English law. The Foreign Enlistment Act of 1870 merely provided that it applied;

*to all the dominions of her Majesty including the adjacent territorial waters.*<sup>83</sup>

But whatever be the limits of territorial waters in the international sense, it has long been recognised that for certain purposes, notably those of police, revenue, public health, and fisheries, a State may enact laws affecting the seas surrounding its coasts to a distance seaward which exceeds the ordinary limits of its territory.

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<sup>76</sup> *ibid* p572

<sup>77</sup> B. Heinzen "The Three Mile Limit : Preserving the Freedom of the Seas" (1959) *Stanford Law Review* Vol.2 p597, 605-612

<sup>78</sup> The *Twee Gebroeders* (1800) 3 C Rob 162, See also Fulton n60 p577

<sup>79</sup> The *Anna* (1805) 5 C Rob 373, See also Fulton n60 p579

<sup>80</sup> Fulton n60 p579

<sup>81</sup> The *Leda* (1856) Swa Adm 40, 166 ER 1007, See also Fulton n60 p586

<sup>82</sup> *ibid* p586

<sup>83</sup> Foreign Enlistment Act (England) (1870) 33 & 34 Vict Ch 90

In a case arising out of a collision close to the English coast between the German vessel *Franconia*<sup>84</sup> and the British vessel *Strathclyde*, the German master was held responsible for the collision. On appeal seven out of thirteen judges held that he was not subject to the jurisdiction of any court in England. The reason was the lack of delimitation of the territorial waters of England and the fact that no statute conferred jurisdiction over foreigners aboard foreign vessels inside or outside territorial waters. As a result of this the Territorial Waters Jurisdiction Act was passed in 1878. Unfortunately this Act did not specify the outer limits of territorial waters, as no breadth was stated. In the preamble the Act refers to the;

*rightful jurisdiction of Her Majesty, her heirs and successors extends and has always extended over the 'open seas' adjacent to the coasts of the United Kingdom and all other parts of Her Majesty's dominions to such a distance as it is necessary for the defence and security of such dominions.*<sup>85</sup>

In the United Kingdom, during the 19th Century other laws fixed the limit for specific cases of jurisdiction beyond three miles. Examples relate to smuggling, public health and slave ships. In some cases the limit was four leagues (12 nm) and in others eight leagues (24 nm). In 1799 the US extended its customs jurisdiction to four leagues (12 nm), Spain had claimed a six nm territorial sea and this was also the customs limit at that time. Sweden claimed six nm and Norway four nm as measured from outlying rocks.

A treaty between Norway and Mexico of 1886 introduced a limit of three nautical miles from the low water line. France claimed two myriametres (12 nm) Italy ten kilometres (5 nm), Austria four leagues (12 nm) and Canada three leagues (9 nm).<sup>86</sup>

A number of French writers such as a Barre're, Champagne and Rayneval wrote on international law and the law of the sea but, with the exception of Rayneval, English jurists regarded them as expressing their anti-British views under the guise of serious dissertations. Rayneval's treatise on international law *Institutions de Droit de la Nature et des Gens* is still quoted however as an authority.<sup>87</sup>

## EXERCISE OF JURISDICTION

In the early 20th century it became generally accepted that a nation was justified in exercising its jurisdiction in sea areas where its security or interests rendered it necessary. It was also felt that the exercise of this jurisdiction in relation to foreigners would be restrained by the doctrine of comity between States or by tacit consent.

Fulton states;

*but it is important to observe that.... maritime nations find it necessary for the protection of their just interests to extend their jurisdiction beyond the somewhat narrow boundary at present ordinarily assigned.*<sup>88</sup>

## CONTROL OF FISHING

After territorial integrity, the second most important consideration of a coastal State is the exploitation and possible depletion of the resources of the adjoining seas. The main resource known to States in earlier centuries was fishing and clashes between States over fishing occurred. As an

<sup>84</sup> *Regina v Keyn* Law Reports, Excheq. Div, ii., 1876-7, p63 See also Fulton n60 p590

<sup>85</sup> Territorial Waters Jurisdiction Act (England) (1878) 41 & 42 Vict Ch 73

<sup>86</sup> Fulton n60 p594 (Fifteenth Ann Rep Assoc. for Reform and Codification of the Law of Nations 18,22 Seventeenth *ibid*, 302, *Annuaire de l'Institute* xi 151)( unavailable to me as a primary source)

<sup>87</sup> Fulton n60 p595/596

<sup>88</sup> *ibid* p595

example, major clashes over fishing rights occurred in the early 19th Century between British and foreign trawlers in the seas around Great Britain.<sup>89</sup>

In 1609, the same year that *Mare Liberum* was published, James I issued his proclamation directed at the great herring fleets of the Dutch of that time.<sup>90</sup> The intention to place a levy on foreign fishing gave rise to the term 'assize-herring'.<sup>91</sup>

William Welwood, an ex-professor of mathematics, who became Professor of Civil Law at St Andrews University, Scotland, endeavoured to refute the arguments expounded in *Mare Liberum*, which he took to be an attack on James' proclamation. As *Mare Liberum* was initially anonymously published he regarded its 'unknown author' as attacking the right of the British to own and control their fishing under the guise of free navigation. He accepted the concept of free navigation, which subsequently became known as 'right of innocent passage', but held that the adjacent waters should be treated differently and that the fish reserves should be protected and that they should be essentially for the use of the coastal State.

He extended this argument in *De Dominio Maris* asserting that dominium over adjacent waters should be similar to dominium over land.

*it is as necessary there as it on land that someone should have jurisdiction and this jurisdiction ought to be exercised by the neighbouring Prince so that both the land and the sea should be under the same jurisdiction.*<sup>92</sup>

Although he was unsuccessful, some of his arguments were later used by Selden. He was however the first publicist to insist that the inhabitants of a coastal state had primary and exclusive rights to the fish resources off their coasts.<sup>93</sup>

Between 1819 and 1822, the Board of British White Herring Fishery forwarded petitions to the Lords of the Treasury. These had been submitted to them by local British fishermen and dealt with the activities of the Dutch herring busses (vessels). Eventually, in 1824 an agreement was reached preventing the Dutch from approaching within six miles of the Scottish coast. For the next eighty years the Dutch refrained from approaching within fourteen miles of the coast and generally kept approximately forty miles offshore.<sup>94</sup>

The same cannot be said of the French fishermen who fished close inshore, in some instances in boats hired from the Scottish. The aggressive attitude of the French continued for some time during the early 19th century and in 1833 a House of Commons Select Committee was appointed to investigate the state of fishing in the English Channel. After lengthy investigations and discussions this committee recommended that the distance of a league from the shore for customs and other coastal State interests should remain but that a controlled fishing area four leagues (12 nm) from the coast should be implemented. It is interesting to note that these distances are identical to those that were later to become generally accepted.<sup>95</sup>

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<sup>89</sup> ibid p604

<sup>90</sup> ibid p9

<sup>91</sup> ibid p351

<sup>92</sup> W Welwood (also referred to as Wellwood) *An Abridgement of All Sea Laws* (1613) p71

<sup>93</sup> Fulton n60 p358

<sup>94</sup> ibid p606

<sup>95</sup> ibid p607 (Report from the Select Committee on British Channel Fisheries, *Parl Papers Sess* (1833) No 676) (unavailable to me as a primary source)

An area was identified in a Convention, concluded in Paris in 1839 between the United Kingdom and France. This considerable area, containing oyster beds in the Bay of Granville on the French Coast, south-east of Jersey, was reserved for the exclusive use of French fishermen.<sup>96</sup>

The Convention did not resolve the disputes as the French fishermen were unhappy about these exclusive areas now introduced and by the fact that the Convention was only binding on the French and British, whereas other States, bordering the area, ignored the restriction. Further conventions were necessary. The 1818 Treaty between the United States of America and the United Kingdom, which allocated US fishing off the coasts of British dominions, particularly Canada, was also causing disputes. The 1818 Treaty was succeeded by the 1854 Reciprocity Treaty, allowing free access to all areas of fishing and this treaty was in force until 1866.

The 1871 Washington Treaty was similar to the 1854 Treaty, which had certain restrictions on British fishing in US waters. US fishermen were obliged to pay heavy compensation of 5,5 million dollars for these restrictions to remain in force and this caused great dissatisfaction in the USA. A period of ten years was stipulated for the operation of the treaty. It was eventually abrogated in 1885. Another treaty, entered into in Washington in 1888, prohibited each State from fishing within three marine miles of the other's coast.

Arguments between the States over fishing continued, both in Europe and America. Conflicting proposals for limits on fishing by different States prolonged the discussions. Eventually the North Sea Convention of 1882 was used as the basis for the British-American Treaty of 1888.<sup>97</sup>

A conference of the North Sea Powers, the United Kingdom, France, Belgium, the Netherlands, Sweden and Norway, Germany and Denmark drafted a treaty at The Hague in 1881 and with the exception of the United Kingdom of Sweden and Norway all signed the protocol.<sup>98</sup>

Provision was made to allow the Kings of Sweden and Norway to sign at a later date, but this was never done although the Norwegian coastline formed a large part of the area under consideration. Exclusive fishing within a three mile territorial sea from baselines was provided for in the treaty. The baselines included straight lines closing bays less than ten nm wide. Freedom of navigation and anchorage was to be allowed, providing the vessels concerned complied with local laws.

### **CLOSING OF BAYS (Early Efforts)**

Although the 1871 Washington Treaty was concerned mainly with the control of fishing it is interesting to note that the Treaty contained the following;

*but at every bay, creek, or harbour, not otherwise specially provided for in this treaty such three marine miles shall be measured seaward from a straight line drawn across the bay, creek or harbour, in the part nearest the entrance where the width does not exceed ten marine miles.*<sup>99</sup>

While bay closing lines and straight baselines had been drawn previously this appears to be the first instance where territorial limits were determined from these baselines and also a maximum length allowed. This was to become the custom for later delimitation. Unfortunately this Treaty was not accepted by the US Senate and was thus never ratified.

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<sup>96</sup> Fulton n60 p612

<sup>97</sup> ibid p630

<sup>98</sup> ibid p632 (Parl Papers Commercial No 24 (1882)) (unavailable to me as a primary source)

<sup>99</sup> ibid p628

## CHAPTER III

## NEW IDEAS IN THE LAW OF THE SEA

## BACKGROUND

A number of the concepts that would later be included in conventions were emerging. Straight baselines, limits to the closing of bays, the right of innocent passage and outer limits of the territorial sea being measured from the baselines were all considered in the North Sea Convention of 1882 and the Washington Treaty of 1888. In 1908 the master of an English trawler, the *Taurus*,<sup>100</sup> was convicted in a German court of fishing within the German three-mile-limit, as contained in the 1881 North Sea Convention. It was established that the English charts of the German coast showed the three-mile-limit as measured from the coast, whereas the German charts showed the limit as being measured from some of the dependant banks. The German determination extended the limit to between six and seven miles from the coast. This was similar to the case of the French corvette *Africaine*<sup>101</sup> which was captured in US waters early in the 19th Century, where the US Congress had defined the limit as one league (three nm) from the coast. The corvette had been six miles from the coast, but less than three miles from some shoals that dried at low tide.<sup>102</sup>

These cases introduced or highlighted the principle of low-tide elevations, which were also to be included in later conventions. The arguments had varying results. Whereas the master of the *Taurus* was convicted, the American judge rejected the same argument on the grounds that the shoals and bank could change reasonably rapidly and were therefore too vague a basis on which to determine a boundary. In the case of the *Twee Gebroeders*<sup>103</sup> a similar argument was also rejected.

Another aspect, considered at the time, was whether 'mud islands, comprising earth and drift wood with reeds growing on them, formed US territory. It was argued that they

*had not sufficient consistency to support the purposes of life and were sometimes scarcely distinguishable.*<sup>104</sup>

Lord Stowell held that the determination of the right of dominium did not depend on the texture of the soil.<sup>105</sup>

While it does not refer particularly to mud islands, Article 121 of LOSC incorporates the concept of sustaining human life to qualify for island status for certain purposes.

<sup>100</sup> Fulton n60 p640 (unavailable to me as a primary source)

<sup>101</sup> *Africaine*:22 Fed Cas (1789-1800) Case No13179, See also Fulton n60 p641

<sup>102</sup> *ibid* p641

<sup>103</sup> *The Twee Gebroeders* n106, See also Fulton n60 p641

<sup>104</sup> *The Anna* n107

<sup>105</sup> *ibid*



The concept of low-tide elevations was further considered, when the British Government rejected claims by British fishermen that French fishing vessels were encroaching in British territorial waters when fishing close to Seven Stones Rocks, which are seven miles off the Cornish coast and submerged at low tide.<sup>106</sup>

This is similar to the attitude adopted at that time to reefs or rocks with lighthouses constructed on them such as Eddystone and Bell rocks.

Another precursor to the treatment of rocks and islands is found in the Anglo-Danish Fishing Convention 1901. This convention regulated the fishing around the Faroes and Iceland and the relevant Article II reads:

*The subjects of His Majesty the King of Denmark shall enjoy the exclusive right of fishing within the distance of three miles from low water mark, along the whole extent of the coasts of the said Islands, as well as dependant islets, rocks and banks.*

*As regards bays, the distance of three miles shall be measured from a straight line drawn across the bay in the part nearest the entrance at the first point where the width does not exceed ten miles.*<sup>107</sup>

## JURISDICTIONAL CASES

New ideas in the law of the sea were advanced in the following cases, some successfully and others not.

### *SS Le Louis*<sup>108</sup>

On 30 January 1816 a French slave trading vessel, *Le Louis*, was seized by a British vessel, *Queen Charlotte*, approximately thirty nm south of Cape Maseruda. The vessel was taken to Sierra Leone where the master was proceeded against in the Vice-Admiralty Court. Arguments were advanced that the British vessel was legally commissioned to act as it did, that the Court's jurisdiction extended to the action of the seizure and that the vessel was fitted out as and was trading as a slaver. The *Le Louis* had resisted the seizure and there was resultant loss of life on the British vessel. It was contended that the French vessel was responsible for this loss of life. The Court held that there was an intrinsic right of independence and equality in States and that the vessels of a State had uninterrupted navigation. Judge Scott held that

*As now generally understood and practised, no nation can exercise a right of visitation and search upon the common and unappropriated parts of the sea, save only in belligerent claim.... It is true that wild claims (alluded to in the argument) have been occasionally set up by nations, particularly those of Spain and Portugal in the East and West Indian Seas .....but these are claims of a nature quite foreign to the present question..... The only way that seizure could be justified was to characterise the French vessel as a pirate.*<sup>109</sup>

This he refused to do.

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<sup>106</sup> *ibid* p642

<sup>107</sup> *ibid* p649 (Convention between His Majesty the King of the United Kingdom of Great Britain and Ireland and His Majesty the King of Denmark for regulating the Fisheries of their respective subjects outside Territorial Waters in Oceans surrounding the Faroe Islands and Iceland Art ii) (unavailable to me as a primary source)

<sup>108</sup> *Le Louis* 2 Dodson 210 165 Eng Rpts (1817) p1464

<sup>109</sup> *ibid* p1476

### **The *Marianna Flora***<sup>110</sup>

A Portuguese vessel, when approached by an American schooner, USS *Alligator*, approximately nine nautical miles off the US coast believed that the US vessel had illegal intentions and in apparent self-defence fired on the US vessel. A small battle ensued and the Portuguese vessel was captured. The lower court awarded the Portuguese vessel damages, but this was reversed on appeal.

In the judgement *a quo* it was stated that;

*Upon the oceans, then, in times of peace, all possess an entire equality. It is a common highway to all, appropriated to the use of all, and no one can vindicate to himself a superior or exclusive prerogative there. Every ship sails there with the unquestionable right of pursuing her own lawful business without interruption but whatever may be that business she is bound to pursue it in such a manner as not to violate the rights of others. The general maxim in such a case is 'sic utere tuo, ut non alienum laedas'.*<sup>111</sup>

It was argued that an area may be drawn around a vessel sufficient for what the Master considers necessary for the protection of his vessel. This is different to the argument that a ship is entitled to that portion of the sea that it occupies and an additional area necessary for the safety of navigation. The rulings on appeal indicated that the concept of an area for protection appeared to be an extension of the shore based 'Cannon Shot' rule and had no authority, recognition or acceptance in law and that the Portuguese vessel had no cause to engage the US vessel.

### **SS *Lotus***<sup>112</sup>

A collision occurred on the high seas between a Turkish and a French vessel, the SS *Lotus*. There was loss of Turkish life by drowning and it was held that the collision occurred as a result of negligence on the part of a French officer, Lieutenant Demons. At a later stage, when the French vessel entered the port of Istanbul, the officer was arrested on a charge of manslaughter. He was tried under Turkish law and found guilty.

The French requested that the Permanent Court of International Justice in the Hague rule on the dispute. The Turks argued that there was a permissive rule allowing them to try this officer and the French argued that there was a rule that imposed a duty on the Turks not to try him. The Court found in favour of Turkey. The Court held that a State may try foreigners who had committed serious crimes against their nationals or the State whether they were committed within or without the limits of the State.<sup>113</sup>

The Court observed, however, that, except in special circumstances vessels on the high seas are subject to no authority except that of the Flag State under whose flag the vessel was registered and sailing.

### **Cunard SS Co v Mellon**<sup>114</sup>

This case arose out of the fact that masters of vessels transporting passengers to the US felt that they were not subject to the jurisdiction of the US Government and the National Prohibition Act when carrying or dispensing alcoholic beverages aboard their vessels. It was ruled however that a merchant vessel of one State is voluntarily subject to the jurisdiction of the State into whose port or internal waters it has passed. A vessel is entitled to the protection of the laws of the coastal State but it is at the sole discretion of the coastal State, as to whether it intends relaxing any of its laws for the vessel while it is in internal waters.

<sup>110</sup> *Marianna Flora* (1826)11 Wheat (24 US) p1

<sup>111</sup> *ibid*

<sup>112</sup> *SS Lotus* World Law Reports (1927) Series A No 10 p23

<sup>113</sup> *ibid*

<sup>114</sup> *Cunard SS Co v Mellon* (1923) 262 US 100 AD (1923-4) Case No 57

To summarise the above case law, the following new ideas were argued;

- a) ship involved in slave trading could be seized by a foreign ship on the high seas. This was rejected;
- b) ship on the high seas could appropriate a protective area around it. This was rejected;
- c) a State could exercise jurisdiction over serious crimes committed against its citizens on the high seas. This was accepted;
- d) a foreign vessel is subject to all the laws of a coastal State when it is in internal waters or port. This was also accepted.

## CODIFICATIONS

A United Nations Division of Ocean Affairs and Law of the Sea publication contains the following:

*A tangle of claims, spreading pollution, competing demands for lucrative fish stocks in coastal waters and adjacent seas, growing tension between coastal nations' rights to resources and those of distant-water fisherman, the prospects of a rich harvest of resources on the seafloor, the increased presence of maritime powers and the pressures of long distance navigation and seemingly outdated, if not inherently conflicting freedom-of-the-seas doctrine—all of these were threatening to transform the oceans into another area of conflict and instability.*<sup>115</sup>

### 1930 Hague Conference and its Aftermath

The 1930 Hague Conference, convened to consider certain international law subjects, failed to reach an agreement on the breadth of the territorial seas. At the final meeting of the Territorial Waters Committee of the Conference the situation had still not been resolved. Some States claimed three miles, some six and the Scandinavian States maintained their claims to their traditional four miles.

Gilbert Gidel subsequently expressed the view that although the Conference had failed to agree on the breadth of the territorial sea, the accepted limit became fixed in a negative sense at three miles, being the minimum limit advocated by all States attending the Conference.<sup>116</sup>

It would appear then that, prior to the 1958 Conference, the minimum breadth of the territorial sea was accepted generally in State practice to be three miles or one league. By 1958 however, twenty seven of the seventy States who had claimed a specific breadth for their territorial waters had claims in excess of three miles. Ceylon, Greece, Haiti, India, Israel, Italy, Libya, Spain and Yugoslavia claimed six miles, Mexico nine miles, Albania ten miles, and Bulgaria, Colombia, Ethiopia, Guatemala, Indonesia, Rumania, Saudi Arabia, the Union of Soviet Socialist Republics, the United Arab Republic and Venezuela had all claimed twelve miles.

A number of States, such as Chile, Ecuador, El Salvador, Korea and Peru had excessive claims up to two hundred miles. Honduras, Lebanon, Portugal, Thailand, Uruguay and the Yemen had claims that were either vague or unknown.

Prior to 1958 there were three categories of navigable waters, inland (internal) waters, marginal seas and high seas.

<sup>115</sup> United Nations DOALOS Publication Law and Order in the Oceans (October 1993) p6-7

<sup>116</sup> Churchill n18 p66 (G.Gidel Le Droit International Public de la Mer Vol 1 (1932)) (unavailable to me as a primary source)

Internal waters were not clearly described, but they did include lakes, rivers, bodies of water almost surrounded by land but open to the sea and certain categories of bays. The waters between the highest and lowest tides were also considered as internal waters. These waters were treated as sovereign territory with no foreign rights other than by agreement.

The 1958 Conference was in session for only two months from 24 February 1958 and was attended by eighty six States. Shalowitz draws attention to the fact that the 1930 Conference was attended mainly by lawyers, whereas the 1958 Conference had a far wider spectrum of delegates with vested interests in the sea, the sea shore and the seabed represented.<sup>117</sup>

The territorial sea, also known as the marginal sea, the adjacent sea, the maritime belt and the three mile limit, had developed into sovereign territory with certain foreign rights such as the right of innocent passage. The straight-line between internal waters and the territorial sea was regarded as a baseline and with other baselines, such as the low-water-line which also separated internal waters (between high and low water) from the territorial sea, became the base from which the breadth of the territorial sea was measured.

### 1958/60 Geneva Conferences

The concept of closing bays by drawing lines between headlands and salient points on the coast was employed by England during the 17th Century to establish the 'Kings Chambers. Although this practice was not generally accepted, it did lead to consideration being giving to the establishment of straight baselines closing 'true bays' at the 1958 Conference.<sup>118</sup> Other bays could be considered for closing in this manner if a State had established sovereignty over the waters of the bay through a long assertion of rights with no opposition from other States. These 'historic bays' could be considered for closure with no limit to the closing distance. This created problems of interpretation as to what constituted a long assertion of rights, what these rights had to be and what time period was necessary for prescription.

Harbours and rivers were also considered and the general opinion prior to the 1958 Conference was that natural harbours and shelters would have to comply with the criteria for true bays to qualify for closure. Outer limits of artificial harbours could enclose internal waters however. Rivers could be classified as internal waters if they flowed directly into the sea and if the closing line drawn across the mouth was in the general direction of the coast. Rivers that flowed into estuaries or bays could not have closing lines unless they satisfied the criteria required for the closing of bays as inland waters.

As a result of the Anglo/Norwegian Fisheries Case the concept of connecting offshore islands with straight baselines had to be considered. Some legal writers consider this judgement as one of the most important judgements to have been made in international law up to the start of the 1958 Conference.<sup>119</sup>

The major problem that faced both the abortive 1930 Hague Conference and the 1958 Geneva Conference was the breadth of the territorial sea. Bowett feels that sovereignty claims relate to the interests and assets that a State may wish to protect.<sup>120</sup> The majority of States with claims greater than three miles were in fact endeavouring to create a zone that would protect their offshore assets. With additional zones now possible he felt that these zones took care of these concerns and the breadth of the territorial sea was no longer as contentious.

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<sup>117</sup> A.L. Shalowitz Shore and Sea Boundaries Vol 1 (1962) p209

<sup>118</sup> *ibid* p22

<sup>119</sup> Anglo/Norwegian Fisheries Case n46 p116

<sup>120</sup> D W Bowett The Law of the Sea (1967) p5

These claims were categorised by McDougal as follows;

- a) control of access to territorial seas;
- b) the application of the national policies of a coastal State via the enforcement of national law to vessels and individuals within the territorial seas;
- c) control of activities undertaken by others within the territorial sea such as radio broadcasting, oil pollution, and navigation generally;
- d) claims to all resources such as fish and the mineral resources of the seabed and subsoil.<sup>121</sup>

Bowett felt that these interests should not be seen as being against the concept of the right of innocent passage.<sup>122</sup>

A six mile breadth for the territorial seas was proposed. It is interesting to note that many Afro-Asian States and, to a lesser extent, the ex-Soviet bloc, argued for a twelve-mile-limit.

The Straits of Tiran and the Gulf of Aqaba were of particular concern to Arab States as they wished to close these to Israeli shipping. Israel would be denied innocent passage as an armistice existed between Israel and the Arab States but not a state of peace. The Arab contention was that the entire Gulf of Aqaba was internal waters for historic reasons.<sup>123</sup> The actions of the Arab States in denying Israel passage to the Port of Eilat resulted in the Six Day War of 1967.

A.H. Dean, Head of the US Delegation to UNCLOS I, stated before the US Senate Committee on Foreign Affairs:

*Our Navy would like to see as narrow a territorial sea as possible in order to preserve the maximum possibility of deployment, transit and manoeuvrability on and over the high seas.....The primary danger to the continuance of the ability of our warships and supporting aircraft to move, unhampered, to wherever they may be needed to support American foreign policy, presents itself in the great international straits of the world - the narrows which lie athwart the sea routes which connect us and our widely scattered friends and allies and admit us to the strategic materials we do not ourselves possess.*<sup>124</sup>

The actions of the US Sixth Fleet off the coast of Lebanon in 1958, the US Seventh Fleet off the coasts of China, the US Fifth Fleet in the Indian Ocean and the British Fleet off Iran in the Persian Gulf in 1950 drew adverse comments from the Byelorussia Soviet Republic:

*the main objective for their naval forces unconditional, so called legitimate, access to foreign waters close to coasts in which they were interested for strategic or political reasons are well understood.*<sup>125</sup>

Western Bloc States argued that a twelve mile territorial sea around all countries would create a vast neutral zone in which Soviet submarines would find a safe haven from which to attack Western surface fleets as the German U Boats had done from Norwegian territorial waters in the 1914-18 and 1939-45 wars.<sup>126</sup>

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<sup>121</sup> M S McDougal & W Burke The Public Order of the Oceans (1962) p1

<sup>122</sup> Bowett n119 p6

<sup>123</sup> *ibid* p8

<sup>124</sup> United Nations Document UN/ A Conf 19/C1/SR 17 (1958) p13

<sup>125</sup> *ibid* p9

<sup>126</sup> A H Dean "The Geneva Conference on Law of the Sea : What was Accomplished" AJIL (1958) p607, 610-611

Further arguments were put forward that to allow twelve nautical miles as the limit of the territorial sea would cause serious economic problems as vessels and aircraft would be obliged to travel longer distances. This argument is invalid as far as vessels are concerned as the 'right of innocent passage' would ensure that they would be able to travel on their usual routes in pursuit of normal trade. Aircraft would have been affected however as there is no right of overflight. Article 6 of the Convention on International Civil Aviation 1944 requires an agreement for scheduled international air services to fly over territorial waters of other States.

The main economic consideration was, however, the exploitation of fish resources. This problem has existed for centuries and the larger well-organised fishing fleets such as those of the Netherlands, Norway, France and the UK, which were capable of fishing at long distances from their home ports, were concerned that the extent of the high seas should not be curtailed. Lesser developed coastal States were well aware that the fish resources off their coasts were being seriously depleted and were equally concerned that even though they may not have been able to exploit these resources themselves, they should be protected for the future. They saw an extension of the limits of the territorial seas as achieving this.

A compromise was advocated with the 'six plus six' formula, which allowed for a six mile territorial sea and a further six miles exclusive fishing zone.

The US was concerned that some fishing operations would be seriously affected by the additional six mile fishing zone and attempted to introduce an exemption for those who had been fishing in the area for a period of five years prior to the Conference. This was unsuccessful, as was their further attempt at the 1960 Conference with a proposal that these fishing operations should be allowed to continue for a limited period of ten years.<sup>127</sup>

A further principle was established that coastal States had an interest in the conservation of fisheries generally including the high seas and this resulted in the Convention on Fishing and Conservation of Living Resources on the High Seas. Any activities in terms of this Convention had to be by agreement with all States concerned and not only the coastal State.

The Conference had adopted a procedure whereby a two-thirds majority was necessary for the adoption of any substantive proposals. Procedural decisions, on the other hand, required only a simple majority for adoption. The result is that although the Conventions were adopted, the breadth of the territorial sea is omitted from the Convention on the Territorial Sea and the Contiguous Zone, due to the lack of the necessary support.<sup>128</sup>

As the Conventions were not acceded to by all States, post-Conference conflicts occurred. This was the case when British warships were dispatched to protect the British fishing fleet operating in fishing areas claimed by Iceland.

The main area of activity, during and immediately after the Conference, occurred in the North Sea and in the area of the Faroes. The UK entered into a series of treaties with Denmark (1959),<sup>129</sup> (1961)<sup>130</sup> and even Iceland (1961)<sup>131</sup> on the basis of a twelve mile fishing zone. All had phase-out periods to enable UK fishermen to readjust to the new limits. The Anglo/Norwegian Treaty had a ten year phase-out period, a period for which consensus was lacking during UNCLOS II. In the case of Iceland it was surprisingly only three years. Similar agreements were entered into between Norway and the USSR. As a result of the more favourable terms received by Iceland from the UK, Denmark endeavoured to renegotiate its 1959 Treaty with the UK. An incident occurred at the time when a Scottish trawler

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<sup>127</sup> Bowett n119 p11

<sup>128</sup> Shalowitz n116 p210

<sup>129</sup> UK Treaty Series No.55 (1959) Cmnd 776

<sup>130</sup> UK Treaty Series No 25(1961) Cmnd 1352 131 Joyner n30 p190

<sup>131</sup> UK Treaty Series No 17 (1961) Cmnd 1328

confined a Danish boarding party onboard their vessel, causing the Danish patrol boat to open fire. The matter was eventually amicably settled and a subsequent agreement was entered into in 1964 to replace the earlier treaty. Denmark then unilaterally applied a twelve mile limit around the Faroes.<sup>132</sup>

### **UN Convention on Law of the Sea 1982**

UNCLOS III may have had its early origins in yet another attempt to resolve the problem of the breadth of the territorial seas. With the coming to independence between 1958 and 1973 of more and more third world States and with the development of the concept of CHM, the scope of the Conference was greatly enlarged. The Sea Bed Committee set up in 1967 by the General Assembly of the United Nations played a large part in the preliminary consideration of aspects beyond the territorial seas.

The major change in the attitude of the States during this period, with regard to the law of the sea, was the development of the concept of the Common Heritage of Mankind (CHM). While the concept may have been considered before, the first public attention that was given to it occurred as a result of the initiative of Ambassador Arvid Pardo of Malta in 1967. The concept is that all the rights and resources of the high seas, its seabed and its subsoil should be for the benefit of all and should not be appropriated by any one State.

The idea would obviously find great favour with landlocked States, States that were concerned that their offshore resources were being depleted by other more industrialised States and by States whose neighbours had greater opportunities to claim areas of high seas. The concept is not restricted to the high seas, but has been applied to areas known as 'common space areas'. These include Antarctica, the moon and outer space.<sup>133</sup> There is a lack of clarity in the concept and while it has had a marked effect on the thinking of international lawyers, its acceptance or appropriate place in international law is uncertain. In 1969 the General Assembly of the United Nations passed Resolution No 2574 on the exploitation of the deep seabed pending the establishment of an international regime to control areas outside national jurisdiction.<sup>134</sup> This was regarded by lesser developed States as a moratorium on development. It became known as the Moratorium Resolution.

By December 1970, General Assembly Resolution 2749, 'Declaration of Principles Governing the Sea Bed and Ocean Floor and the Subsoil thereof beyond the Limits of National Jurisdiction' was accepted with no negative votes being recorded. Seventy seven developing States regarded this as binding and that the Resolution prevented further seabed mining. A 'Sea Bed Committee' was formed as a preparatory commission for UNCLOS III.

The CHM doctrine, as it had then become, appeared to have five basic principles;

- a) there would be no appropriation of common space areas by any private, public, national or corporate body;
- b) all would participate in the management of the area;
- c) all would benefit from the exploitation of the areas;
- d) all common space areas must be restricted to peaceful use;
- e) research and exploration would be open to all with the proviso that common areas were not threatened physically or ecologically.<sup>135</sup>

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<sup>132</sup> UK Treaty Series N117 (1961) Cmnd 1575

<sup>133</sup> Joyner n30 p190

<sup>134</sup> Churchill n18 p180, O'Connell n47 p25

<sup>135</sup> Joyner n30 p191

The deep-sea bed was separated from other common space areas and a more radical regime advocated. A New International Economic Order (NIEO) for these areas would have three major differences to the CHM doctrine;

- a) the World Community would have legal ownership of the area;
- b) the profits from the exploitation would accrue to all with special preferential treatment being given to developing States;
- c) an International Deep Seabed Authority was created in LOSC to control deep seabed mining when LOSC comes into force and another similar authority was required to exercise jurisdiction over the common areas. It is considered unlikely that this authority would ever receive the support of the developed States.<sup>136</sup>

The distinction between *res nullius* and *res communis* was again considered in the context of the CHM doctrine. The intention of the CHM is for there to be non-ownership and non-proprietorship in the common space areas. This would then prevent the possible transfer of ownership. The key consideration would be access to the area and not ownership of it. Under a CHM regime a legal right would be created to use the international space without any attendant rights of ownership, possession or sovereign acquisition of title.<sup>137</sup> For this to be applied successfully there would have to be an international authority which would be responsible for the implementation of the principles as listed. The main reason for the rapid acceptance in principle of the CHM doctrine would have been the potential value of the seabed resources and in particular manganese nodules. In the light of developments, both technologically and in commercial markets, these estimates now appear to have been grossly exaggerated.<sup>138</sup>

While this may be so, the acceptance of the application of the CHM doctrine to common space areas appears to have become generally more important. It can be seen in the lack of exploitation of Antarctica and outer space that CHM has played a significant role in preserving such areas for future generations. No State has laid claim to outer space and no development has taken place in Antarctica but Australia has laid claim to both a portion of the Antarctic continent and intends to lay claim to the Continental Shelf off the Antarctic Continent in accordance with LOSC.<sup>139</sup> Joyner is of the opinion that CHM has not been shown by State practice to be accepted as international law but the concept did play a role in drafting of the Articles of LOSC so that many States could accept the Section dealing with the exploitation of the deep sea bed.<sup>140</sup>

Three Conference Committees were formed to consider aspects of the law of the sea and these covered an extremely wide range of subjects.

#### **Committee I**

This committee was required to consider the question of the exploration and exploitation of the sea bed. It took cognisance of the feelings of the advocates of CHM and also the proceedings of the Sea Bed Committee.

#### **Committee II**

This committee was expected to consider the regime of the territorial sea, the contiguous zone, the continental shelf, exclusive economic zone, the high seas, fishing and the conservation of the living resources of the high seas.

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<sup>136</sup> *ibid* p193

<sup>137</sup> *ibid* p193/4

<sup>138</sup> DA Ross *Opportunities and Uses of the Ocean* (1980) p59

<sup>139</sup> R Hill, Australian Minister for the Environment and Heritage & A Downer Australian Minister for Foreign Affairs Joint Media Release (2 December 1999)

<sup>140</sup> *ibid* p198



### Committee III

This committee was to consider the preservation of the marine environment and scientific research and additional ad hoc groups were tasked with other relevant Conference tasks. The procedure of consensus applied by Committees II and III was successful allowing Articles relevant to these two committees to evolve during the Conference to the point where they received general acceptance by attending States.<sup>141</sup>

### The Results of Work of these Committees

The Convention Document was finally available in 1982 and in spite of dissension over the Articles dealing with the deep sea bed the Convention was adopted by 130 votes to 4 with 17 abstentions. This may appear conclusive but regrettably the abstentions included a number of major States. It was also clear that while a large number of States were prepared to sign the Convention it was highly unlikely that a large proportion of the major industrialised States, such as the US, the UK, Canada, European States, Japan, Scandinavian States and Australasia, would ratify the Convention.

Resolution I, which was adopted at the same time as the Convention text, contained provisions for the formation of a Preparatory Commission (PREPCOM) to the International Sea Bed Authority and the International Tribunal for the Law of the Sea. The signature of, or accession to, LOSC by fifty states was required for Resolution 1 to come into effect.

The Conventions arising out of the 1958 UNCLOS I had a total of 106 Articles with some duplication of procedural Articles as there were four separate Conventions. LOSC has 320 Articles with a further 116 in nine annexes.

The criteria to delimit maritime zones of coastal States are contained in the Articles of LOSC. These zones include internal waters, territorial waters, contiguous zones, exclusive economic zones and a continental shelf. Most of these zones are generated from baselines on the coast of the coastal State. The technical implications will be considered in detail in later Chapters and they are therefore only described generally as follows. LOSC came into force on 16 November 1994, one year after Guyana, the sixtieth State, ratified it.

### Straight Baseline

*Mathematically the line of shortest distance between two points in a specified space.*

As straight lines may be used to close bays and to replace the normal baseline, the low-water-line, care must be taken in the manner that the co-ordinates of these lines are computed. If the straight line is relatively short it is possible to calculate, depict and relate to the line for everyday use. Geodetic principles are essential when computations are undertaken to ensure that the boundary resulting from such calculations will be internationally acceptable.

While there are factors particular to each case essential requirements common to all cases include accurate mapping of the sea bed and undersea features.

### Internal Waters

Article 8(1) of LOSC states;

*Except as provided in Part IV, waters on the landward side of the baseline of the territorial sea form part of the internal waters of the State.*

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<sup>141</sup> Churchill n18 p15

With the exception of the continental shelf determinations the outer limits of the zones of a coastal State are all measured from baselines on the coast. This baseline is the normally the low water line. In certain circumstances, contained within LOSC<sup>142</sup> this baseline may be replaced with straight baselines, which commence and end on the low water line. Waters contained within (landward of) the baselines of a State are internal waters. These waters are also sometimes referred to as national waters or interior waters.<sup>143</sup>

As these waters are considered sovereign territory and all the laws of the coastal State are enforceable in these waters, LOSC does not have many Articles dealing with internal waters. Waters, now enclosed by baselines which were previously territorial waters or where innocent passage had been exercised are regarded as internal waters with the proviso that right of innocent passage will prevail.<sup>144</sup>

### **Territorial Waters.**

*Every State has the right to establish the breadth of its territorial sea up to a limit not exceeding 12 nautical miles, measured from the baselines determined in accordance with this Convention.*<sup>145</sup>

Territorial waters are measured from the baselines to a maximum of 12 nm. The limits are dependent on whether delimitation with an opposite or adjacent State is necessary.

Provided that delimitation with another State or States is not necessary the coastal State may determine the extent of its territorial seas and exercise sovereignty over these seas. A proviso is that innocent passage is a right of a Flag State. The coastal State may however designate sea lanes and traffic separation schemes in which this right must be exercised but the use of these lanes and schemes must not pose a threat to the safety of navigation as shown in Chapter IX.<sup>146</sup> These implications will be considered in the Chapter VII dealing with Navigation and the rights of both coastal and Flag States.

The delimitation of the territorial sea and the other zones includes lateral boundaries between States if adjacent and a median line if opposite. In the consideration of these boundaries Article 15 states;

*Where the coasts of two States are opposite or adjacent to each other, neither of the two States is entitled, failing agreement between them to the contrary to extend its territorial sea beyond the median line every point of which is equidistant from the nearest points on the baselines.*<sup>147</sup>

Positions on any outer limit boundary must be 12 nm from the nearest point on the baseline. In practice this means that a prominent point will generate the outer limit for some distance. The baseline could be a normal baseline on the mainland, an island, a low tide elevation such as a reef or sandbank and on permanent outer harbour works. It could be a straight baseline or a bay, delta or river closing line.

The distances from the baselines should be accurately determined and the methods of geodetic computation will be considered in Chapter IV. The final positions must be plotted and shown on the largest scale chart of the coastal State or on a co-ordinate list with the geodetic datum supplied.<sup>148</sup>

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<sup>142</sup> LOSC Article 7

<sup>143</sup> Churchill n18 p51

<sup>144</sup> LOSC Article 8(2)

<sup>145</sup> LOSC Article 3

<sup>146</sup> LOSC Article 22(1)

<sup>147</sup> LOSC Articles 5, 6, 7, 9, 10, 11, 13

<sup>148</sup> LOSC Article 16

## Contiguous Zone

This zone is defined in LOSC as:

- 1) *In a zone contiguous to its territorial sea, described as the contiguous zone, the coastal State may exercise the control necessary to:*
  - a) *prevent infringement of its customs, fiscal, immigration or sanitary laws and regulations within its territory or territorial sea.*
  - b) *punish infringement of the above laws and regulations committed within its territory or territorial sea.*
- 2) *The contiguous zone may not extend beyond 24 nautical miles from the baselines from which the breadth of the territorial sea is measured.*<sup>149</sup>

The need to exert some form of control beyond the extent of a coastal State's territorial sea had been a concern of coastal States for many years. In the 18th Century Great Britain (UK) enacted the 'Hovering Acts' which were meant to be enforced to counter the activities of foreign smuggling vessels which approached to within 24 nm of the coast of the UK. Although these acts were applied from 1736 until their repeal in 1876 the last vessel to actually be seized was the French vessel *Petit Jules*. This vessel was apprehended 23 nm seaward of the Isle of Wight.<sup>150</sup>

It is clear that while coastal States are prepared to adopt limits on their territory extending seawards they still expect certain conduct from foreign vessels in the areas immediately contiguous.

In 1930, at the Hague Conference, the concept of a contiguous zone was not a contentious issue. Unfortunately this was related to the breadth of the territorial sea and as this could not be agreed to the idea of a contiguous was not adopted.<sup>151</sup>

## Exclusive Economic Zone

*The exclusive economic zone shall not extend beyond 200 nautical miles from the baselines from which the breadth of the territorial sea is measured.*<sup>152</sup>

The benefits to the coastal State of this zone are confined to the exploration, preservation and exploitation of all resources whether mobile or sedentary, renewable or non-renewable. Most of the rights reserved for other States are concerned with either navigation or communications.

*Two contrary ideas have been expressed as to the extent of national jurisdiction of the coastal State in the exclusive economic zone;*

*it is not logical to question that the coastal State exercises in the zone the characteristic attributes of national jurisdiction.*<sup>153</sup>

*and*

*However, the rigorous provisions of the Convention that have been examined do not lead to the conclusion that the exclusive economic zone is a zone of national jurisdiction.*<sup>154</sup>

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<sup>149</sup> LOSC Article 33.

<sup>150</sup> Churchill n18 p112

<sup>151</sup> *ibid* p114

<sup>152</sup> LOSC Article 57

<sup>153</sup> AA Schreiber "The Exclusive Economic Zone: its Legal Nature and the Problem of Military Uses" p133 in I F Orrego Vicuna (ed) *The Exclusive Economic Zone*, (1989) p44

The intentions of the Second UNCLOS Conference Committee, when Articles 55-75 of LOSC were drawn up are however stated in the text presented by Ambassador Andres Aquilar Chairman of the Committee as being;

*Nor is there any doubt that the exclusive economic zone is neither the high seas nor the territorial sea. It is a zone sui generis... the rights as to resources belong to the coastal State and, in so far as such rights are not infringed, all other States enjoy the freedoms of navigation and communication.*<sup>155</sup>

Orrego argues that there is a major difference between 'sovereign rights' and 'jurisdiction'. Whereas sovereign rights can be non-restrictive, jurisdiction, as applied to coastal States in economic zones, is accorded to the coastal by being party to LOSC. This jurisdiction would still have to be translated into national legislation.<sup>156</sup>

In Article 58(2) reference is specifically made to Articles 88 -115 and other pertinent rules of international law that apply in the exclusive economic zone. These Articles deal with rights, privileges and obligations of States in regard to the high seas. The inference is therefore that these apply in the economic zone with the exception of those specifically designated to the coastal State.<sup>157</sup>

In 1932 Council for the Government of Canada in their case of Croft v Dunphy<sup>158</sup> concerned with the validity of the Customs Act of Canada authorising the seizure of vessels stated;

*But whatever be the limits of territorial waters in the international sense, it has long been recognised that for certain purposes, notably those of police, revenue, public health, and fisheries, a State may enact laws affecting the seas surrounding its coasts to a distance seaward which exceeds the ordinary limits of its territory.*

The freedom of navigation of foreign warships is considered in Chapter IX.

The coastal State has the sole right to construct or authorise the construction of installations and artificial islands in its exclusive economic zone.<sup>159</sup> The coastal State has exclusive jurisdiction over its own structures and jurisdiction for customs, fiscal, health, safety and immigration over all structures.<sup>160</sup> The consequences of this are discussed in Chapter IX. structures it is also beholden on the coastal State not to erect these structures in recognised and essential international searoutes.

### Continental Shelf

*The continental shelf of a coastal State comprises the sea-bed and subsoil of the submarine areas that extend beyond its territorial sea throughout the natural prolongation of its land territory to outer edge of the continental margin, or to a distance of 200 nautical miles from the baselines from which the breadth of the territorial sea is measured where the continental margin does not extend up to that distance.*<sup>161</sup>

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<sup>154</sup> *ibid*

<sup>155</sup> United Nations Document UN/CONF.62/WP. 8/Rev 1/Part II, par 17,18 6 May 1976 Official Records, Vol V, (1976)

<sup>156</sup> Schreiber n152 p25, LOSC Article 56

<sup>157</sup> *ibid* p21-22

<sup>158</sup> Croft v Dunphy 148 Law Times Reports p62 (Jan 28 1933)

<sup>159</sup> LOSC Article 60(4)

<sup>160</sup> LOSC Article 60 (1)(2)

<sup>161</sup> LOSC Article 76(1)

The implications of Article 76 are considered in Chapter VI. There are complex criteria, contained in this Article that have been subject to various interpretations. The situation is further complicated by the status given to islands.

One of the criteria establishing a maximum to which a continental shelf claim of a coastal State may extend is a requirement of LOSC<sup>162</sup> for the outer limit to be less than 100 nm from the 2500 meter isobath. A second requirement is that the outer limit must be less than 350 nm from the baselines from which the territorial sea is measured. A coastal State may use whichever is the greater of these two criteria.

Due to the fact that Article 76 LOSC provides for claims by a coastal State to continental shelf, which may include areas that are geologically considered to be deep ocean floor, bathymetric and seismic surveys may have to be conducted to depths below 3000 metres.

Seismic surveys to determine sediment thickness are expensive so the 2500 meter isobath and the configuration of the seabed in the region of the foot of the slope should therefore be accurately surveyed before a determination can be made and before seismic surveys are undertaken.

A number of States have historically provided world navigation chart folios, such the British Royal Naval Hydrographic Office at Taunton United Kingdom. This dates from the years when the developed States had colonies and surveyed in these waters purely for reasons of trade. The British were responsible for a considerable amount of the hydrographic surveys being undertaken world-wide.

Although it has been between 50 and 60 years since the UK has conducted surveys other than off their own coast or by arrangement with their previous colonies or dominions they still produce a world folio. This is as a result of the majority of developed States being Members of the International Hydrographic Organisation (IHO) which facilitates the exchange of hydrographic data and information between member States.

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<sup>162</sup> LOSC Article 76 (5)

## PART II

### LOSC IN FUNCTIONAL PERSPECTIVE

#### CHAPTER IV

#### GEODESY

##### INTRODUCTION

Various physical factors and criteria are referred to in LOSC. For them to have an effect on the interpretation and implementation of the Convention and for the LOSC Articles to have any meaning they must be related to some positioning reference system. Whenever sovereign territories or boundaries are considered with their attendant rights and regimes, States must have a clear and unequivocal understanding of the positions and limits involved.

Some limits are dependent on geographical or geological factors or on computations based on these factors. The ability to transfer these positions from the earth's surface to permanent and understandable records must therefore exist. The positions must be accurate, readily available and practical. Where a position is not clearly indicated on the earth's surface by a geographical or geological feature, the calculated positions must be easy to be relocated, for practical use, by those who may not be familiar with geodesy.

The first and major problem to be overcome is the shape and size of the earth itself and how it is possible to calculate mathematically on its surface and then be able to indicate accurately important positions.<sup>163</sup>

LOSC is not specific as to the criteria to be used in the implementation of its provisions, in particular those that relate to lateral and zonal boundaries. It is easy therefore for the uninitiated to believe that the solution to their positioning problems is in the use of a particular map projection. The determination of positions and lines on a map projection would only appear to be correct. Some map projections, and in particular the commonly used Mercator projection which is used for the compilation of the standard nautical chart, would not provide accurate and acceptable solutions to boundary determinations.

LOSC requires that the delimitation and delineation of boundaries should be shown on charts and maps of a scale large enough for ascertaining their positions or that a list of geographical co-ordinates of points on the boundaries be provided with the geodetic datum of the system noted.<sup>164</sup>

The impression amongst many who are unaware of the implications is that the positions of boundaries may therefore be calculated on charts instead of being calculated geodetically and then shown or depicted on charts and maps and gives an indication of the confusion that exists. A lack of appreciation of the errors such methods could introduce is therefore evident and should be realised as widely as possible.

The limits of territory should be established by internationally approved survey methods. Distances of 12 nm, 24 nm, and 200 nm, measured from positions or baselines on the coastline of continents or islands on

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<sup>163</sup> P Vanicek & E Krakiwsky *Geodesy: The Concepts* (2<sup>nd</sup> Ed) (1986) p3

<sup>164</sup> LOSC Articles 16,17 and 84

the earth's surface are used in LOSC to determine the maximum outer limits of territorial waters, contiguous zones and exclusive economic zones.<sup>165</sup> Similarly points on the coast on either side of a land boundary are used to subtend equal distances to positions in order to determine lateral boundaries between States.<sup>166</sup> Distances of 350 nm from these same baselines, 60 nm from the foot of a continental slope, and 100 nm from the 2500 metre isobath are used to determine the maximum possible continental shelf claim of a coastal State.<sup>167</sup>

The Anglo/French Arbitration Tribunal<sup>168</sup> appointed experts to calculate the delimitation of the English Channel in accordance with the award of the Tribunal. The Tribunal decided to accept the nautical charts of the area as produced by both the UK and France for their coasts. The scales of these charts were 1:20 000 and 1:25 000 respectively.<sup>169</sup>

The basepoints adopted had not been updated since the publication of the charts in 1950 and 1972 respectively, although a datum exchange was used to ensure that the baselines on both sides of the Channel were on the same system.<sup>170</sup>

Subsequent computations, with updated and additional basepoints, indicate that the original allocation of continental shelf was in error by 18-20 sq km in the UK's favour in one sector and 80 sq kms and 50 sq kms in France's favour in the other two.<sup>171</sup> As cartographic solutions are still being utilised, the problems and errors inherent in the use of these methods are obviously not clearly understood by all.<sup>172</sup>

The age-old problem of relating a position on, above, or below the earth's surface to some form of calculated, written, or depicted reference system is exacerbated in areas covered by the sea. The position to which reference is made cannot usually be permanently marked on the surface. Although it is now possible to leave markers at reasonable depths on the seabed, in most cases it is necessary to recreate the initial position determined by survey or navigational methods with reference to co-ordinates lists or positions shown on charts or maps.

For this to be achieved accurately, the exact shape of the earth at any point, the assumptions made, the mathematical reference systems, the projections used and any other factors that could affect the accurate referencing of positions must be known and evaluated.

## HISTORICAL BACKGROUND OF GEODESY

To understand the problems related to position fixing it is necessary to consider the development of the science that gives mathematical definition to the shape of the earth. This science is known as geodesy, from the Greek words meaning 'partitioning the earth'. The practice of survey, astronomy, geography, cartography and other related sciences are therefore totally dependent on geodesy.<sup>173</sup>

Long before the ability to measure or to calculate existed, early man contemplated the earth, its shape and its size. Other than the mythical ideas that derived essentially from early Grecian philosophers, the first attempts to measure the earth in its entirety began with early astronomers, navigators and cartographers. During the 9th Century BC, Homer and the Ionian philosophers regarded the earth as a flat disc supporting a hemispherical sky. Thales of Miletos,

<sup>165</sup> LOSC Articles 3, 33(2), 57

<sup>166</sup> LOSC Article 15

<sup>167</sup> LOSC Article 76(5)

<sup>168</sup> Anglo/French Continental Shelf Arbitration Cmd 7438 18 ILM 397, ILM Vol 18 (1979) p153

<sup>169</sup> G Carrera. "A Further look into the 1977 Anglo-French Arbitration Agreement Concerning the Continental Shelf Boundary in the English Channel and South-Western Approaches" (1994) (Unpublished paper kindly made available to me by the author) p3.4

<sup>170</sup> *ibid*

<sup>171</sup> *ibid* p3.6-3.7

<sup>172</sup> *ibid* p3.13

<sup>173</sup> I Fisher "The Figure of the Earth : Changes in Concepts" Geophysical Surveys Vol. 2 (1975) p6

6th-7th Century BC, rested this disc on water spouts as did the Babylonians. In the same century Anaximander had the disc fixed to an infinite depth by air trapped under it. He did however address the vexing problem facing the advocates of the flat-earth concept, that the sun and stars set in the west and the next day rose again in the east. He retained the disc but advocated that the path of the sun and stars passed under the disc to rise again in the east.<sup>174</sup>

Pythagoras and his 6th Century BC disciples are credited with first advocating the concept of a spherical earth. His ideas stemmed, however, from speculative contemplation and not from observations. His mystical considerations did, however, include placing the earth as one of the bodies travelling around the sun and not as the centre of the universe, an idea generally accepted at that time.

By the 5th Century BC it was generally accepted that the shape of the earth was spherical but no determination or estimation of its size had been made or proof of its shape offered. Aristotle suggested a gravitational theory, based on the fact that, as all objects fell down, all matter strove to attain a central position and so the earth eventually approximated a sphere. Evidence to indicate the curvature of the earth, to the early philosophers, was the gradually increasing visibility of an approaching ship as it appeared, mast first, over the horizon.

Two early determinations of the circumference of the earth existed at that time but were without authorship although one was thought to have been a calculated guess by Archimedes.<sup>175</sup>

The first attempt to determine mathematically the shape and size of the earth was undertaken by Eratosthenes in the 3rd Century BC. He was aware that the summer-solstice sun rose to a vertical position over Syrene, south of Alexandria on the Tropic of Capricorn, latitude 23,33 degrees North, and shone down a well there. At the same time it was noted that the sun was not vertical over Alexandria, at a different latitude. He rightly assumed that the sun's rays to both positions were parallel and therefore there would have to be curvature between the two positions to account for the difference in verticality of the sun's rays.

He determined the angular difference in height of the sun, probably by shadow-stick observations. After measuring the distance between the two cities and relating it to the angular differences measured, he was able to extend the value of the arc measured and to calculate the full circle, which would be the earth's circumference. The exact unit of measure used is not accurately known today, but a general comparison of this determination with modern observations indicates that Eratosthenes achieved extremely creditable results. There were no telescopes, theodolites, optical levels, accurate measuring devices, computers, nor established survey practices on which to base the angular and linear measurements and this determination must rank as a most outstanding scientific achievement.<sup>176</sup>

During the 9th Century AD, Caliph Al Mamum was responsible for a determination of the circumference of the earth by the measurement of an arc of meridian near Baghdad and Al Raggah, in modern Iran. It is considered a possibility that Christopher Columbus could have misjudged the distance to the Far East, along the line of latitude he was sailing, by using Al Mamum's results, but using Italian miles instead of the Arabian miles used by Al Mamum in his calculations. The difference of 25% experienced by Columbus could have caused a miscalculation of approximately 2400 km in the estimated distance to reach the Far East.<sup>177</sup>

During the 16th and 17th Centuries great strides were made in the fields of astronomy, survey and navigation. This was as a result of the invention of telescopes, verniers, thermometers, barometers and the method of compensation of magnetic compasses. In 1533, Gemma Frisius published the

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<sup>174</sup> ibid p5

<sup>175</sup> J R Smith Basic Geodesy (1988) p3

<sup>176</sup> Vanicek n162 p8

<sup>177</sup> Smith n174 p11



principles of triangulation, whereby it was possible to determine the distance between two distant positions by firstly measuring a short base very accurately. The measured base would then be one side of a triangle, the angles of which had also been accurately measured.<sup>178</sup> By calculating the remaining sides it would be possible to extend the calculations to the chain of triangles whose angles had also been accurately measured. Additional bases would be measured along the chain and at the end to ensure accuracy. It became possible, therefore, to reduce the amount of difficult and time-consuming linear measurement between distant points to a minimum and to observe, rather, the faster, easier, angular measurements.

This technique was developed and put into practice, in 1620, by Willibrod Snellius who measured a triangular chain in the Netherlands between Bergen op Zoom and Alkmaar.<sup>179</sup> Subsequently, many distinguished European geodesists used this method to determine arcs of meridian in various parts of the world. In France several arcs were measured under the supervision of the famous Cassini family.

It became evident that the circumference of the earth varied if measured at different angles to the meridians, which are circles on the earth's surface passing through its poles. It was correctly reasoned, therefore, that the earth could not be a true sphere. Isaac Newton, who had been experimenting with fluids, was of the opinion that the earth was not a sphere, but an oblate spheroid. This is a three-dimensional figure, similar to a sphere but flattened at the poles. This was supported by most observers except the French scientists led by the Cassini family.<sup>180</sup>

The generally accepted shape of the earth indicated therefore that the polar radii were shorter than the equatorial radii and that this gave rise to the oblate spheroidal figure (tomato or pumpkin shaped). The French maintained that the shape of the earth approximated to a prolate spheroid (egg shaped) with larger polar radii than equatorial radii. Arcs were then measured at sites from Peru to Lapland and these confirmed the oblate spheroid theory. Voltaire commented to the returning Peru team:

*You have found by prolonged toil what Newton had found without even leaving his home.*<sup>181</sup>

The debate was rekindled for a while as a result of the observations that had been made at the Cape by the Abbe de la Caille. This renowned astronomer observed an arc of meridian from a station on the side of Devils Peak to a station near Darling in the North. Unfortunately deviation in the plumb lines of his instruments, due to the unexpected gravitational effect in the area altered the verticality of these instrument's and also his observations. This resulted in erroneous conclusions being made.<sup>182</sup>

The early assumption that the earth was spherical made the task of the surveyors and cartographers, who were trying to produce a plane representation of the earth, very difficult. The fact that the earth was actually spheroidal with complicated mathematical representations, made their task even more onerous.

Variations in the earth's topography, comprising apparently large height differences, such as the Himalayan Mountains, have little effect on the overall consideration of the earth's shape. This will be appreciated when it is noted that the highest mountains are 8 km high as against the earth's radius of 6400 km, a ratio of 1:800.

The earth's topography can therefore be regarded as a minutely irregular veneer on the surface of an ellipsoid, defined later in this Chapter. What is important are the ellipsoids adopted to approximate the

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<sup>178</sup> ibid p13

<sup>179</sup> ibid

<sup>180</sup> ibid

<sup>181</sup> ibid p15

<sup>182</sup> Fisher n172 p16/17

shape of the earth in an area and the horizontal and vertical datum points that are taken for these ellipsoids.<sup>183</sup>

## GEOID

*The one gravity equipotential surface of particular interest is that which best approximates the (mean) sea level over the whole earth. It is called the geoid.*<sup>184</sup>

*Under certain assumptions they ('ocean surfaces') form a part of a level (equipotential) surface (surface of constant gravity potential) of the earth's gravity field. We may think of this surface as being extended under the continents and then identify it as the mathematical figure of the earth (Helmert A1880/1884). JB Listing (1873) designates this level surface as the 'geoid'*<sup>185</sup>

As a result of more recent satellite observations, indications are that there is additional flattening at approximately latitude 30 North and a bulging between 30 and 60 South. An incomplete mathematical representation exists for the geoid at this stage.<sup>186</sup> As the shape of the geoid is dependent on the direction of gravity, a final mathematical figure for the geoid will only be determined when world-wide gravity observations, particularly over seabeds, are complete.<sup>187</sup>

## SPHEROIDS AND ELLIPSOIDS

A problem of terminology exists in regard to the use of the terms spheroid and ellipsoid. Traditionally geodesists from the UK have referred to spheroids, whereas their colleagues in other States have referred to the same figures as ellipsoids.

Smith states, however, that a further subtle distinction can be found in that a spheroid could refer

*to any slightly non-spherical shape but not necessarily a mathematically definable one.*<sup>188</sup>

### Ellipsoids

An ellipsoid(spheroid) or an 'ellipsoid of rotation' is obtained by rotating an ellipse about either of its two axes. This is frequently referred to as a 'reference ellipsoid'. If the rotation is about the minor axis the resulting solid is known as an 'oblate ellipsoid' and if about the major a 'prolate ellipsoid'.

An ellipsoid is a solid through which all plane sections through one axis are ellipses and through the other axes are ellipses or circles. If any two of the three axes of an ellipsoid are equal it becomes a spheroid and if all are equal it becomes a sphere. A rotational ellipsoid is therefore an ellipsoid as there are only two axes, a and b. In practical geodesy and surveying bi-axial ellipsoids have been referred to as ellipsoids.<sup>189</sup>

The reference surfaces required by geodesists are rotational models, obtained by the rotation of an ellipse about an axis, usually a minor axis. The resultant figure is an ellipsoid. The ellipsoids that approximate most closely to the earth's shape are oblate and the minor axis about which the rotation occurs is the polar axis. This axis passes through the geographic poles of the earth. As the geoid could vary considerably from a global reference ellipsoid adopted to approximate the earth, locally adopted ellipsoids were intended to give better coincidence with the geoid in that area. This ensured that the national survey or mapping reference ellipsoid of a State approximated the geoid as closely as

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<sup>183</sup> ibid p17

<sup>184</sup> Vanicek n162 p87

<sup>185</sup> W Torge *Geodesy* (2<sup>nd</sup> Ed) (1991) p2

<sup>186</sup> Smith n174 p26

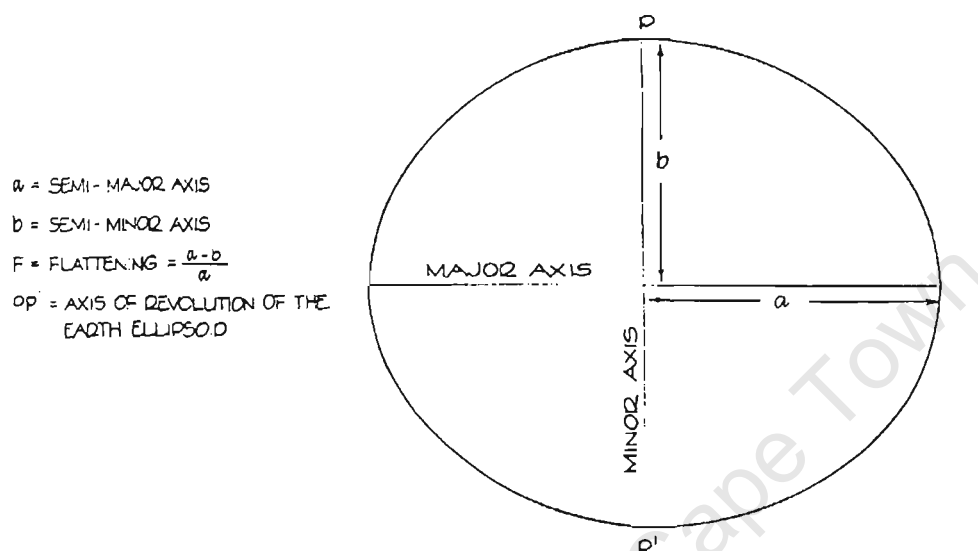
<sup>187</sup> ibid p27

<sup>188</sup> ibid p25

<sup>189</sup> ibid

possible.<sup>190</sup> With the advent of satellite-positioning systems this has been reconsidered and many States are adjusting their national systems to a global reference system.

The tri-axial ellipsoid is mathematically the viable surface closest to the geoid. It has three perpendicular axis positioned in the earth. Major and medium axes are in the equatorial plane and the minor axis is co-incident with the minor polar axis of inertia. The ellipsoid is defined as major axis (2a) medium axis (2b) minor axis (2c) and the orientation of the major axis in the equatorial plane.<sup>191</sup>



**Figure 1 OBLATE ELLIPSOID SHOWING MAJOR AND MINOR AXES**

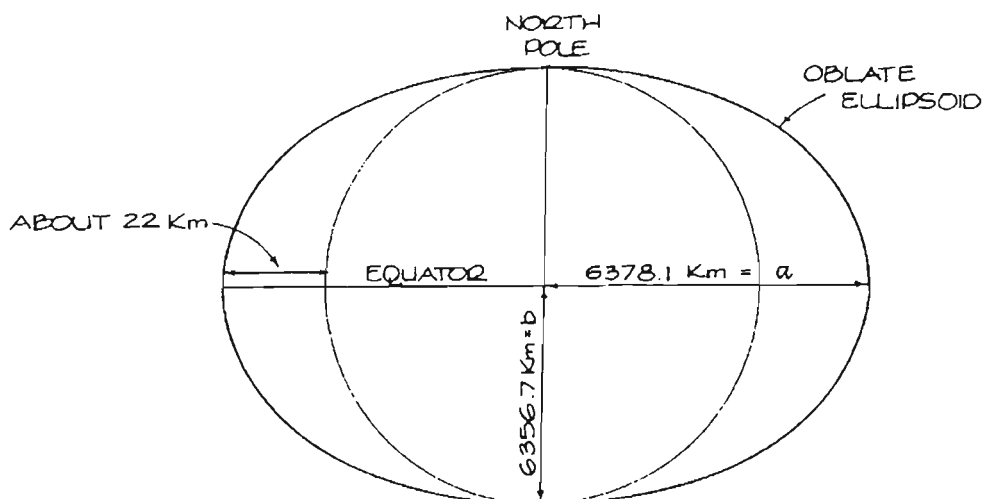
Determinations of the parameters of these various regional ellipsoids have been made by many scientists since the 19th Century and most national geodetic systems are based on ellipsoids that were calculated at that time. These ellipsoids are usually named after the geodesist who made the determination and it is often the case that adjoining States have survey, mapping and charting systems based on different reference ellipsoids. The differences in the systems and datum could result in delimitation complications in the areas where the States adjoin. States embarking on a lateral boundary delimitation between them should be aware of this and should make the necessary adjustments to bring values from the two systems to a common system that is acceptable to the States concerned. An example is the relationship between the RSA's geodetic system which is based on the Clarke 1880 ellipsoid and the two adjoining States, Namibia and Mozambique, which are based on Bessel's 1841 and Clark's 1860 ellipsoids respectively.<sup>192</sup>

It is possible to calculate co-ordinates on any reference ellipsoid provided that the values and datum of the ellipsoid are known. The positions on the coasts adjoining the proposed delimitation would then be calculated or converted to one of the ellipsoids, the lateral boundary determined and the co-ordinates reconverted to the systems being used by the States concerned.

<sup>190</sup> ibid p21

<sup>191</sup> Vanicek n162 p107

<sup>192</sup> South African Navy Hydrographic Publication SANHO-21 South African Sailing Directions Vol. 1 (1994) Ch1 p10



**Figure 2 THE APPROXIMATE DIFFERENCES IN THE LENGTHS OF THE AXES OF THE EARTH**

Some of the reference ellipsoids used by States are shown in Table 1.<sup>193</sup> The basic elements of an ellipsoid are;

$a$  = semi-major axis ( Equatorial radius)

$b$  = semi minor axis ( Polar radius)

$f$  = the flattening which is determined by the formula  $(a-b)/a$ <sup>194</sup>

For global reference ellipsoids the axis of rotation of the earth should be coincident with the semi-minor axis of the ellipsoid.<sup>195</sup>

### GEOMETRY OF THE ELLIPSOID

With the axis of rotation being the polar ( $z$ ) axis each of the infinite number of positions of the ellipse defines a meridional ellipse or meridian. Angle  $\lambda$  (measured in the  $xy$  plane from the  $x$  axis) is the longitude of all points on the meridional ellipse. Although the polar axis subtends the angles from which longitude is measured, the centre of the ellipsoid is not the centre of curvature for the latitudes of points on the surface. It follows therefore that the normal to the ellipsoid at a position on the surface, which will determine verticality at that position, will be directed to positions on the polar axis and not necessarily to the ellipsoidal centre.<sup>196</sup>

The mean level of the sea is determined by observations of tidal activity duly corrected for all possible influences of the full lunar cycle of 18.61 years. The distribution of sea water world-wide is subject to semi-permanent inhomogeneity due to the shape of coastlines and other oceanographic and geographic factors such as the permanently higher temperatures of the water in the equatorial latitudes compared with those of the seawater in the polar regions. Many of these effects can be measured. These

<sup>193</sup> Smith n174 p23, International Hydrographic Organisation (IHO) A Manual on Technical Aspects of the United Nations Convention on the Law of the Sea (TALOS) 3rd Ed (1988) p57

<sup>194</sup> Smith n174 p23

<sup>195</sup> N Bowditch The American Practical Navigator US Defence Mapping Agency Pub No 9 Vol II (1995) p16

<sup>196</sup> G Bomford Geodesy 3rd Ed (1971) p110/111

departures , known as ‘sea surface topography’, from a hypothetical state corresponding to an undisturbed homogeneous fluid (geoid) can be reasonable estimated.<sup>197</sup>

#### LIST OF ELLIPSOIDS

ELLIPSOIDS	MAJOR SEMI AXIS	1/FLATTENING
AIG 1975	6378140.	298.257
AIRY 1830 HOTLINE (SEE AIRY 1848)		
AIRY 1848	6377563.3963	299.3249646
AIRY 1924 WAR OFFICE		
AIRY MODIFIED	6377340.1891	299.3249646
AIRY-US	6377542.178	299.325
APL MK 4.5	6378137.	298.25
APL NAVIGATION	6378144.	298.23
APL 5.0 6378140.	298.26	
APL-OMA	6378165.953	298.3
AUSTRALIA 185	6378165.	298.3
AUSTRALIAN NATIONAL	6378160.	298.25
BESSEL 1841	6377397.155	299.1528128
BESSEL FM 1841	6377397.155	299.152813
BESSEL NORWAY	6377442.018	299.1528
BESSEL US	6377393.72	299.15
BESSEL 1841 PORTUGAL	6377397.155	299.1528
CLARKE 1858	6378293.645	294.26
CLARKE 1868	6378206.4	294.9786982
CLARKE 1866 MICHIGAN	6378450.047	294.978698
CLARKE 1880 ENGLAND	6378249.1453	293.465
CLARKE 1880 IGN	6378249.2	293.466021
CLARKE 1880 MODIFIED	6378249.1388	293.466308
CLARKE 1880 PALESTINE	6378300.7893	293.466307
CLARKE 1880 FIJI		
DANISH	6377104.43	300.
DENMARK	6377019.26	300.
DELAMBRE 1810-CARTE DE FRANCE	6376985.	308.64
DGFI 1986	6378144.11	298.257
DGFI 1987	6378136.	298.257
DU PLESSIS ‘RECONSTITUE’ AMS 1944	6379523.994	
EVEREST 1830	6377276.3452	300.8017
EVEREST BARI	6377301.2435	300.801725
EVEREST BORNEO	6377298.556	300.8017
FISCHER 1955	6378155	298.3
GERMAIN	6378284	294.28
GEM-NASA	6378155	298.255
GHANA NATIONAL	6378295.	296.004037
GSFC 145	6378145.	298.255
GSFC 138	6378138.	298.255
HAYFORD 1909 (see HAYFORD {INTERNATIONAL})	6378388	297
HEISKANEN 1929	6378400.	298.2
HELMERT 1907 (1906)	6378200.	298.3
HOLLANDAIS	6376850	309.6
HOUGH	6378270	297
IAG GRS 1967	6378160	298.247167
IAG GRS 1980	6378137	298.257222
INTERNATIONAL 1924		
JEFFREYS 1948	6378099	297.1
JMR SP3 1976		
KRASSOWSKY URSS	6378245	298.3
MALAYAN (EVEREST MODIFIED)	6377304.063	300.8017
MERCURY 1960	6378166	298.3
MERCURY MODIFIED 1968	6378150	298.3
NASA 6378148	298.3	
NASA-GEN9	6378140	298.255
NASA-GEM10B	6378138	298.257
NWL 8E		
PLESSIS 6376523	308.64	
POIDS-MESURES 1799	6375739	334.29
REFERENCE 1867		
SAO SE-1	6378165	298.25
SAO SE-3	6378140	298.256
SOUTH AMERICAN 1969	6378160	298.25
STRUVE ESPAGNE	6378298.3	294.729991
SVANBERG SUEDE	6376797	304.2508
UAI 1964	6378160.	298.25
UTEX 6378137	298.255	
WALBECK URSS	6376895.	302.782157
WGS 1960	6378165.	298.3
WGS 1966	6378145.	298.25
WGS 1972	6378135.	298.26
WGS 1984	6378137	298.257223563

**Table1 SOME ELLIPSOIDS ADOPTED FOR VARIOUS PORTIONS ON THE SURFACE OF THE EARTH**

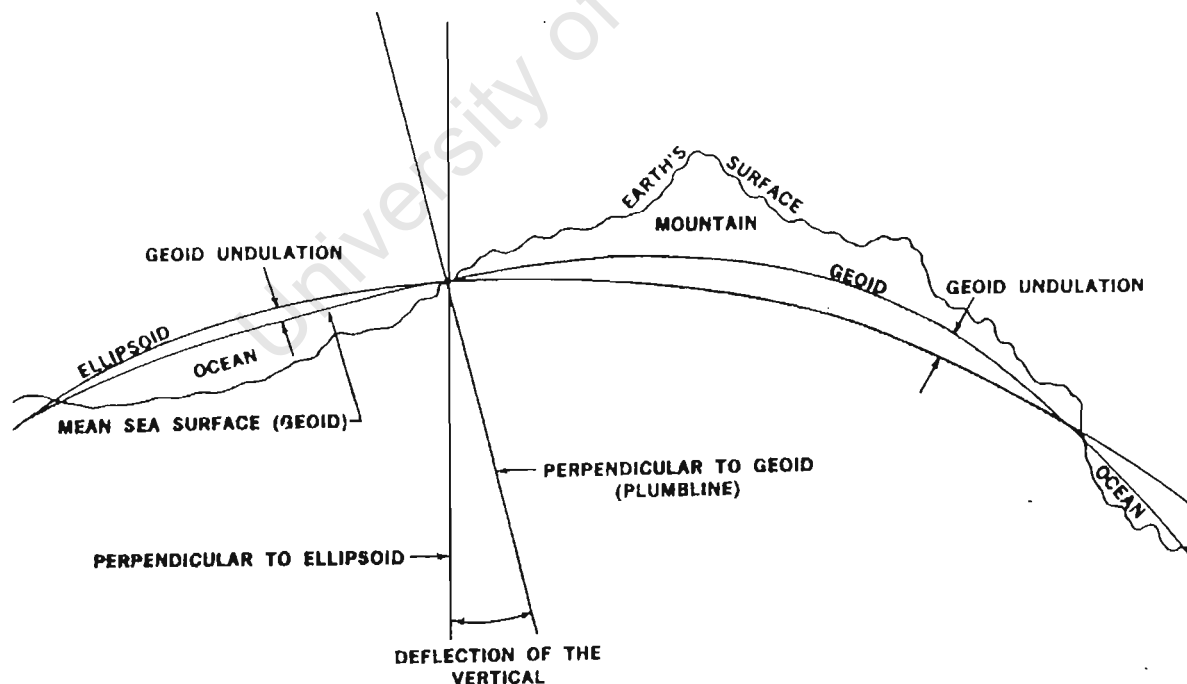
<sup>197</sup> British Admiralty (BA) Manual of Hydrographic Surveying Vol 2 (1969-1982) Chap 2 p3, Vanicek n162 p105

These corrections are necessary due to the fact that the sea is subject to the influence of the rotation of the earth and of lunar and stellar attraction forces. Tidal observations are subject to weather and climatic conditions, which must be eliminated or compensated for. The astronomical corrections have to be applied as a series of constituents. These could vary in number up to 2000, depending on the accuracy required. While a national survey system is related to a specific mathematical ellipsoid, the vertical datum is, at present, related to the mathematically more complex geoid through a fixed position, on the geoid adopted as the datum.

As a horizontally observed plane at a position on the surface of the geoid is perpendicular to the direction of gravity at that position, and as the direction of gravity varies according to the structure and composition of the earth, it will be noted that the geoid will also vary. Its shape can be regarded as smooth but undulatory. The gravity field of the earth is fundamental to the geodesist in that;

- a) it defines the shape of the earth;
- b) it is directly related to the height-reference systems;
- c) it can dictate the accuracy of determinations on the surface;
- d) it facilitates the establishment of simpler mathematical formulae for the shape of the earth.

The height of a position is measured above mean sea level (geoid). The difference between the geoid and the ellipsoid is known as the geoidal height. The geodetic height of the position (height above the ellipsoid) is therefore the summation of the height and the geoidal height at a point. The geoidal height could be positive or negative depending on whether the geoid is above or below the ellipsoid at that position.<sup>198</sup>



**Figure 3 AN EXAMPLE OF POSSIBLE RELATIONSHIPS BETWEEN THE EARTH, GEOID AND AN ELLIPSOID**

<sup>198</sup> G Carrera An Introduction to Geodetic Aspects of International Maritime Boundaries and Offshore Limits (1994) (unpublished paper kindly made available to me by the author.) p17

<sup>199</sup> IHO n192 p55

Geodetic ellipsoids are often used as reference for horizontal positioning with the co-ordinates given as geodetic latitude and longitude (geodetic horizontal datum). Coupled with the geodetic height they can be converted to Cartesian X,Y, and Z co-ordinates on a geocentric Cartesian system. This system has been used in satellite and space programme positioning. Localised ellipsoids and datum have non-geocentric geodetic datum.

A geodetic datum is defined by

- a) a reference ellipsoid (size and shape)
- b) the position and orientation of the ellipsoid with respect to the earth (three translations and three rotations)<sup>200</sup>

The local datum and ellipsoids are generally chosen to meet a number of local requirements, which are essential to achieve the best fit of geoid and ellipsoid in the area. These requirements included the orientation of the ellipsoid, the geoid-ellipsoid separation at a datum point (usually accepted as zero at the datum point), the orientation of the datum with the geodetic network originating from this datum and the orientation of the ellipsoid vertical (ellipsoid or prime normal) and the gravitational vertical.<sup>201</sup>

Geodetic surveys are normally required in the following cases;

- a) the determination of the low water line, which defines the normal baseline, or basepoints for straight-line segments of a baseline system, if claimed, by a State in accordance with LOSC;
- b) the positioning and/or check of the geodetic co-ordinates of points and bench marks;
- c) the conversion from one geodetic datum to another or the definition of a common datum;
- d) the determination of the datum used for original positions which may not have been properly or adequately documented;
- e) the readjustment of ancient and/ or distorted surveys.<sup>202</sup>

Terrestrial means of observing distances, and computing the subtended angles, improved with the development of electronic distance-measuring devices. The accuracy of these distance measurements resulted in the greater use of trilateration over triangulation. Trilateration is the co-ordination of the points of a triangle, or chain of triangles, by the measuring of the lengths of the sides, whereas triangulation is the measurement of the angles of the triangles. With the advent of artificial satellites, extraterrestrial measurements were improved, but as global reference ellipsoids were required for these satellites, it presented the opportunity to relate the global reference ellipsoid to the many local ellipsoids in use.

Positions may be fixed in a point mode by the determination of co-ordinates in a well defined system. A relative means of determination, whereby co-ordinate differences from one point to another point are used, may be employed and is sometimes referred to as differential positioning.

Although the majority of delimitation determinations will be done on local ellipsoids, the advent of these satellite and global geodetic systems has meant that eventually all national systems could be related via a global system. With the introduction of the Navstar Global Positioning Systems

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<sup>200</sup> Vanicek n162 p325

<sup>201</sup> IHO n192 p59

<sup>202</sup> ibid p69

(GPS) any survey or navigation undertaken using GPS receivers will give positions related to WGS 84, a global ellipsoid.

These will have to be converted to whatever ellipsoid has been used to produce the chart or map before these positions can be plotted on them.<sup>203</sup> The accuracy of the GPS system will be considered in Chapter VI.

The first global datum, the World Geodetic System (WGS 60) was developed by the United States of America in 1960. This was followed by WGS 72 and WGS 84. In 1979 the International Union of Geodesy and Geophysics adopted, in Canberra, a new geodetic reference system (GRS 80). This replaced GRS 67 as the official reference for geodetic computations. It should be noted that WGS 72 and WGS 84 include ellipsoids developed by the American Defence Forces and, while in all respects, GRS 80 is an identical the WGS 84 ellipsoid, there are differences of an academic magnitude.<sup>204</sup> Delimitation on the surface of the earth, that are referenced to a local geodetic system or are in areas where more than one datum exists, will require the following to establish co-ordinates from distance and angular measurements:

- a) the use of geodetic methodology;
- b) the establishment of the relationship between the observable factors and undetermined parameters;
- c) the identification of these parameters;
- d) the measurement of the observable factors;
- e) the formulation of a mathematical model;
- f) the solving of the unknowns;
- g) the assessing of the accuracy of these procedures.<sup>205</sup>

## UNITS OF MEASURE

The relationship between the various units used by surveyors and the various standard values of these units complicates the comparison of surveys that may be considered when delimitation is made. This can be illustrated by the history of the metre and its relationship to other units of measure.

The original proposal, in 1791, that a metre be equal to 1/10 million of the meridian quadrant of the earth, based on an arc determination done in France, resulted, in 1798, in a bar of impure platinum being defined as the physical representation of the standard metre.<sup>206</sup>

In 1841, Bessel's determined the size of the quadrant to be 10 000 856 metres. This meant that another definition had to be found. In 1889, thirty copies of a prototype metre were distributed to various countries, including the United Kingdom, the United States and Russia. The method of relating the standard metre to a fraction of the quadrant or to a physical bar was found to be impractical. As early as 1890, Sir David Gill advocated the use of wavelengths of natural substances, such as sodium vapour, as the standard. Others, like Michelson and Benoit, used wavelengths of red cadmium radiation. In 1960 the metre was defined as 1 650 763,73 wavelengths in vacuo of the

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<sup>203</sup> ibid p74

<sup>204</sup> Carrera n197 p19 and IHO n192 p67

<sup>205</sup> ibid p17, M Kumar "Marine Geodesy: Some Initiatives (Special International Commission Established Seeking Equivalence Between Land, Marine Positioning Research)" *Sea Technology* (October 1992) p71

<sup>206</sup> Smith n174 p30



radiation corresponding to the transition between two specific energy levels of the Krypton 86 atom. The 1983 General Conference on Weights and Measures, (Conference Generale des Poids et Mesures[CGM], ) held in Paris, defined the metre as the distance travelled by a ray of light in a vacuum in 1/299 792 458 of a second.<sup>207</sup> The methods of defining this unit of measure have improved the consistency and reliability of the metre as an international standard. If this is related to earlier versions of the metre and to all the other units used in surveys world-wide and the changes that they may have been subject to, it is apparent that delimitation should ideally be based on only the latest most accurate surveys. The most accurate conversion of these other units to a common unit of measure is equally essential.

Similarly, the nautical mile is stated in LOSC as the unit of measure for establishing the outer limits of maritime zones.<sup>208</sup> This unit of length has not been defined in LOSC, but it was defined as 1 852 metres at the 1929 International Hydrographic Conference (IHC) and has been adopted as such by the majority of maritime States, but it is not a definition binding on States. Consideration must also be given to the fact that, after delimitation is agreed upon using this value, the daily user, the navigator, will use a different value for the nautical mile.<sup>209</sup>

For the navigator the nautical mile is one minute of arc of latitude. This means that the nautical mile will vary in length with the latitude at which it is measured. A nautical mile measured at the equator would equal 1842.8 metres whereas at the pole it will be equivalent to 1861.7 metres.<sup>210</sup> The value adopted by the IHC approximates the mean of these two values.

## STRAIGHT LINES

One of the most vexing problems associated with determinations on the earth's surface is the definition of a straight line. In terms of LOSC straight lines may be drawn to replace the normal baseline, which is the low-water line,<sup>211</sup> to close bays<sup>212</sup> or around archipelagic States.<sup>213</sup> In addition the outer limits of the continental shelf may be demarcated by straight lines less than 60 nm long.<sup>214</sup> No definition of a straight-line is found in customary law, nor has a definition been included in any International Court of Justice decision or arbitration award.

The shortest distance between two points on a plane surface is a straight line and this definition has been, on occasions, erroneously transferred into the world of surveys and mapping of curved surfaces. A line of constant azimuth (loxodrome) appears as a straight line on a chart constructed using a Mercator projection. It does not do so on a map employing a Transverse Mercator projection. The map or chart is a representation of the earth in plane view and, regardless of the projection used, distortion of some aspect of the positions of surface features must exist and straight lines on most charts bear little relationship to the shortest distance between two points on the geoid or ellipsoid.<sup>215</sup>

A geodesic line is defined as;

*the shortest line on a mathematically derived surface between two points on that surface. A geodesic line on a reference ellipsoid is called a geodetic line.*<sup>216</sup>

<sup>207</sup> *ibid*

<sup>208</sup> LOSC Articles 3, 47(2), 53(5), 57, 76, 82(1), A2/1, A2/3, A2/4

<sup>209</sup> IHO n192 p22

<sup>210</sup> Bowditch n194 p446

<sup>211</sup> LOSC Article 7

<sup>212</sup> LOSC Article 10

<sup>213</sup> LOSC Article 47

<sup>214</sup> LOSC Article 76(7)

<sup>215</sup> *ibid*, F Mayer et al "Algorithm for the Calculation of Geodetic Distances for Maritime Jurisdictional Boundaries" *IHR* LXIX (1)(March 1992) p140

<sup>216</sup> IHO n192 p45

To close bays <sup>217</sup> or to replace irregular coastlines with straight baselines <sup>218</sup> it is apparently simple when these positions are considered on a Mercator chart. If the intention in closing a bay with a straight line is to facilitate navigational positioning and enforcement of the applicable regime, then a straight line drawn on a chart would be an option appreciated by a navigator. Where these straight lines are to generate limits of up to two hundred nautical miles seaward or where valuable resources have to be delimited then the straight line will have to be geodetically generated.

## GEODETIC COORDINATE SYSTEM

It is vital to consider the various possible co-ordinate systems that can be used and the implications on the veracity of a recorded position on the earth's surface. Some of these systems are Cartesian, which was discussed at the beginning of this Chapter, and others on the Geocentric Polar Co-ordinate System. This system has x, y and z co-ordinates values with the z-axis parallel to the earth's axis of rotation and the x, y axes that rotate with the earth. The origin should be the earth's centre of gravity. <sup>219</sup>

## Datum Transformations

In areas where different national datum positions for reference ellipsoids exist, transformation parameters will be required to transform either system to the other and to determine positions on the same ellipsoid. There are three translation components ( $\Delta x, \Delta y, \Delta z$ ) which relate the two positions on the systems and three rotations ( $\Sigma x, \Sigma y, \Sigma z$ ). The rotations adjust the system for differences of orientation and could be of lesser magnitude. The values of these parameters can be derived from the co-ordinate values on the systems and will change from point to point. As the co-ordinates have errors of various magnitudes, the parameters derived from them will likewise contain errors. <sup>220</sup>

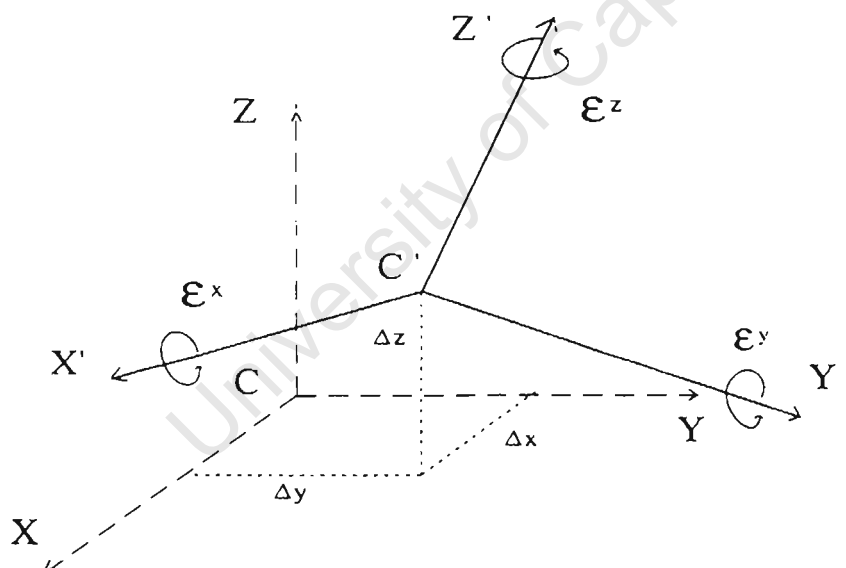


Figure 4

## GEODETIC ROTATIONS

A further problem could arise in that some of the older systems have datum that may not have been adequately defined, if at all. This would then make transformation exceedingly difficult or impossible.

<sup>217</sup> LOSC Article 10

<sup>218</sup> LOSC Article 7

<sup>219</sup> IHO n192 p59

<sup>220</sup> ibid, P Done "The Geoid and the Vertical Datum Problem" *The Hydrographic Journal* No32 (April 1984)

Where the vertical datum position is not based on the consistently accurate recording of tidal data over long continuous periods of time, with the optimum period being 18.61 years, an essential factor in the positioning of base points from which to measure the final limits of the delimitation will be absent. Compromises will have to be made and agreed to by the States concerned in the delimitation.<sup>221</sup>

Accurate modern tidal observations, taken on site at the time of a survey would however give a reasonable determination in the absence of the definitive data required. Tidal observations conducted over one year will not differ by more than 10 cm from a full-range determination. Determinations over shorter periods will differ accordingly.<sup>222</sup>

For practical purposes, separate chart and levelling datum positions have been adopted. For land survey and mapping, a Land Levelling Datum (LLD) is adopted and, in the South Africa, LLD's were adopted in four ports, Cape Town, Port Elizabeth, East London and Durban. The intention was that the LLD should coincide with mean sea level, but subsequent determinations of mean sea level and a comparison of the levels at the ports indicate that this was not always successful.

Precise lines of spirit levelling were undertaken throughout the RSA. These levels were then based on a Cape Town tide-gauge benchmark, which was adopted as the datum for South Africa. The variations in mean sea-level, as occurring around the coast of South Africa and the errors inherent in levelling of this nature resulted in differences being found when connecting the levelling to benchmarks at the other ports. These variations could be as a result of the factors mentioned in sea surface topography.

### **Nautical Charts in Delimitation**

Nautical charts are specifically designed for the safe passage of vessels. Compilation procedures are devised to ensure that all information necessary for safe navigation is clearly and concisely displayed. While it is vital that the information displayed is accurate, these charts were never intended to be sea-maps. Care must be taken, therefore, when considering seabed information depicted on a nautical chart. This information has been compiled in such a manner that it ensures that dangers on the seabed are clearly brought to the attention of the navigator. The compiler has licence to smooth contours to facilitate the use of the chart and to exclude features that are not relevant to navigation. As most users are mariners, nautical charts should be used to display information about the maritime zones that are claimed by coastal States. They should not be used in the determination of these zones unless there is no other information available.

If mean sea level were to be adopted as the chart datum, as is the case for land maps, it is theoretically possible that minus depths will have to be indicated to reflect the lowest depths. Chart datum is therefore chosen at a set height (depth) below LLD and below the lowest possible tide to ensure that all depths shown on a chart are positive.<sup>223</sup> Most States have adopted Lowest Astronomical Tide (LAT) as Chart Datum.

### **SATELLITE POSITIONING FOR NAVIGATION OR SURVEY**

Navigational services offered via satellites give positions that relate to the WGS 84 ellipsoid. The charts used by the navigator, are however usually still based on local ellipsoids and positional discrepancies are inevitable. This could create an enforcement problem for coastal States and, if the same methods are used to determine positions for survey purposes, the problems will be exacerbated. Horizontal differences of the magnitude of 200-300 metres could occur in certain areas. Coupled with GPS observation accuracy of 100-300 metres problems could be experienced, especially where the delimitation of territory or resources is critical. Many coastal States intend converting both

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<sup>221</sup> Bowditch n194 p150

<sup>222</sup> C L Merry "Reference Systems and Datum Surfaces" : The Surveying of Offshore Mining Concessions in South African Waters Symposium (7 February 1984) p10

<sup>223</sup> Bowditch n194 p730

land maps and nautical charts to WGS 84, but this involves considerable effort by the mapping agencies concerned. Many years could pass before this type of positioning ceases to be a problem.<sup>224</sup>

University of Cape Town

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<sup>224</sup> R T Wonnacott "The Conversion of the South African Co-ordinate System to WGS 84" Proceedings of IALA RAD 1 Conference (1995)

## COMMENTED GLOSSARY OF TERMS RELEVANT TO GEODESY IN LOSC

(Unless otherwise stated all definitions are taken from A J Kerr, NR Guy et al IHO Manual on Technical Aspects of United Nations Convention on Law of the Sea 1982 3rd Ed 1993.)

### GEODETIC DATA <sup>225</sup>

Parameters defining geodetic or astronomical reference systems and their mutual relations, horizontal vertical and/or three dimensional co-ordinates of points referred to such systems; observations of high precision from which such co-ordinates may be derived; ancillary data such as gravity, deflections of the vertical or geoid separation at points or areas referred to such systems.

#### Comment.

Wherever possible, geodetic calculations based on the most reliable datum must be used in delimitation or delineation.

### GEODETIC DATUM <sup>226</sup>

*A geodetic datum positions and orients a geodetic reference system in relation to the geoid and the astronomical reference system.*

A geodetic datum is defined by

- a) a reference ellipsoid (size and shape)
- b) the position and orientation of the ellipsoid with respect to the earth (three translations and three rotations) (From page 51)

#### Comment

Local or regional datum of reference ellipsoids are adopted by States where the ellipsoid approximates the closest to the geoid in that area. This ensures that the mapping and charting produced, related to this datum, reflects closely the positions of features on the earth's surface. The axis of this local datum should be parallel to the astronomical reference system.

With the advent of man-made satellites, a global datum was necessary to reference the orbits. The current global datum adopted is GRS 80, which is designed to coincide as near as possible with the global geoid. This datum is used by geodesists. WGS 84, the reference ellipsoid used in satellite-positioning systems and for future mapping and charting, approximates very closely to GRS 80.

All references to co-ordinates in LOSC require that the co-ordinates are geodetic and that the local datum is also listed. This must include the "deflections of the vertical" and the "geoidal separation at the datum point". The relationship of local datum to one another becomes vital where a delimitation of a maritime boundary between two States is being considered and the reference systems of the two States are not on the same ellipsoid.

### GEODETIC COORDINATE SYSTEMS <sup>227</sup>

*A geodetic co-ordinate system is defined by specifying an ellipsoid of rotation (also termed a spheroid by Anglo-US Geodesists) which requires:*

- a) *Semi-axis major and flattening or*

<sup>225</sup> LOSC Articles 16(1) 47(8)(9) 75(1)(2) 76(9) 84 and 134

<sup>226</sup> LOSC Articles 16(1), 47(8), 75(1) and 84(1)

<sup>227</sup> LOSC Article 76(9)

- b) *semi-axis major and second zonal gravity harmonic (J2). Co-ordinates are three-dimensional cartesian referred to an origin at the centre of the spheroid with the Z-axis along the axis of symmetry, or geodetic geographicals with an associated geodetic height.*

#### **Comment**

Many different ellipsoids are adopted regionally to achieve a best fit with the geoid in the area. These ellipsoids are used in local mapping and charting. Before a comparison or conversion can take place between different geodetic reference systems, exact details of the systems are vital.

#### **GEOGRAPHICAL CO-ORDINATES <sup>228</sup>**

*Angular parameters of latitude and longitude, which define the horizontal position of a point on the reference surface and which in conjunction with a height, similarly define positions vertically above or below such point.*

*Astronomical latitude and longitude relate to the mean axis of rotation of the earth and the direction of the local plumb line vertical: latitude is the angle this vertical makes with a plane normal to the rotation axis: longitude is the angle that a plane containing this vertical and a line parallel to the rotation axis makes with a reference plane through the rotation axis (Greenwich Meridian plane).*

*Geodetic latitude and longitude are similarly defined with the earth's rotation axis replaced by that of the reference ellipsoid (the z axis); the plumb line vertical replaced by the normal to the reference ellipsoid; and the plane of the meridian of Greenwich replaced by the x z co-ordinate plane of the reference ellipsoid.*

#### **Comment**

Calculations must be done on a geodetic reference system and any geographical co-ordinates used must be converted from the geodetic ones. As those involved in enforcement or the exploitation of resources in zones, whose boundaries have been computed geodetically, are usually using navigational aids based on geographical co-ordinates, the boundary co-ordinates will have to be converted back to geographicals after the geodetic computations are complete.

#### **LOW-WATER LINE/ MARK <sup>229</sup>**

*The intersection of the surface of low water with the shore. The line along the coast, or beach, to which the sea recedes at low water.*

#### **Comment.**

The low-water line is a nebulous boundary, which is difficult to survey. Most cadastral mapping extends as far as the high water line, but LOSC has defined the low-water line as the 'normal baseline' from which all maritime zonal boundaries are measured, except the outer limits of the continental shelf, and where straight baselines or closing lines have replaced the low-water line.

Where there is a large tidal range and the beach profile and gradient are such that a falling tide will retreat horizontally considerable distances seawards, the outer limit of this exposed area could increase the territory of a coastal State considerably. It could be the main or only reason for adopting the low-water line as a baseline to measure maritime zones.

Hydrographic surveys are conducted up to the high-water line and while local tidal observations are recorded during survey operations, these are used to relate the bathymetry of the survey to a chart

<sup>228</sup> LOSC Articles 16, 47(8), 47(9), 75(2), 84 and 134(3)

<sup>229</sup> LOSC Articles 5, 6, 7(2), 9, 10(3), 10(4), 10(5) and 13(1)

datum. The lowest tide will occur during an 18,61 year cycle and, even if weather conditions were suitable it is impracticable to attempt such determinations over a large area of coast.

#### **SCALE** <sup>230</sup>

*The ratio between a distance measured on a chart or map and a distance between the same two points measured on the surface of the earth (or other body of the Universe).*

#### **Comment**

LOSC requires that co-ordinates;

*..shall be shown on charts of a scale or scales adequate for ascertaining their position.* <sup>231</sup>

Unless charts are specifically surveyed and compiled for delimitation purposes, nautical charts are being used for this purpose. The largest scales of these charts are of the order of 1:10 000 around ports and harbours and 1:150 000 off the coast. It is essential, therefore, that charts, at appropriate scales, are compiled and used to display co-ordinates that have been geodetically surveyed.

#### **STRAIGHT LINE** <sup>232</sup>

*Mathematically the line of shortest distance between two points in a specified space.*

Comment As straight lines may be used to close bays and to replace the normal baseline, the low-water line, care must be taken in the computation of the co-ordinates of these lines. If the straight line is relatively short it is possible to calculate, depict and relate to the line for everyday use. Geodetic computations are essential to achieve an internationally acceptable result.

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<sup>230</sup> LOSC Articles 5, 16(1), 47(8), 75(1) and 84(1)

<sup>231</sup> LOSC Article 5, 6, 16, 22(4), 47(8), 53(10), 75, 76(9), 84, 134(3)

<sup>232</sup> LOSC Article 7, 8(2), 9, 10(5), 14, 16, 47, 48, 49, 76(5)

## CHAPTER V

### GEOGRAPHY

#### INTRODUCTION

The International Court of Justice highlighted the significance of land and geographical features in boundary delimitation. In the North Sea Continental Shelf Cases<sup>233</sup> the Court held;

*The land is the legal source of the power, which a State may exercise over territorial extensions seaward.*

In the Aegean Sea Continental Shelf Case the Court held that maritime rights exist:

*solely by virtue of the coastal State's sovereignty over the land.*

and that they are;

*both an emanation from and an automatic adjunct of the territorial sovereignty of the coastal State.*<sup>234</sup>

The Court held, in the Tunisia/Libyan Case<sup>235</sup> that:

*The geographic correlation between coast and submerged areas off the coast is the basis of the coast's legal title....The coast of the territory of the State is the decisive factor for the title to submarine areas adjacent to it.*

The primacy of geographic considerations can be found in the delimitation of every zone, regardless of how the delimitation was carried out.<sup>236</sup> The nature, position and extent of the geographical features of a coastal State is of such importance to any delimitation that the coastal State should ensure that this information is current and accurate. This applies to all delimitation, whether to determine the boundaries between opposite or adjacent States or the outer limits of a maritime zone.

Where a boundary is being determined the lengths of the coastlines of the States concerned have been considered in the delimitation, but the difference in the size of the landmass of the States has not been accepted as a criterion that can be utilised to affect a delimitation. There are notable instances where landmass has not been considered as in the four consecutive agreements between Finland and the USSR. These agreements were based on the application of the equidistant principle and no account was taken of the vast difference in the relative landmasses of the two States.<sup>237</sup>

<sup>233</sup> North Sea Continental Shelf Cases (1969) ICJ Rep 1 51 para 96

<sup>234</sup> Aegean Sea Continental Shelf Case (1978) ICJ Rep 3 36 para 86)

<sup>235</sup> Case Concerning the Continental Shelf (Libya/Tunisia) (1982) ICJ Rep 13 64 Para 73

<sup>236</sup> P Weil "Geographic Considerations in Maritime Delimitation" in JI Charney & LM Alexander (eds) International Maritime Boundaries Vol 1 (1993) p 115

<sup>237</sup> Finland/Soviet Union. 566 UNTS 37 (1966), 640 UNTS (1968), 33 Vedomosti Verkovnogo Soveta S.S.S.R. (Communication of the Supreme Soviet of the USSR) 676 (1980) & 1 (1987)



The influence of the difference in landmass was raised by the Danish Technical Advisor's submission to the International Court of Justice in the Jan Mayen Case. He pointed out that the radial distances measured from a relatively small island and used to generate maritime zones around the island was inequitable when compared to a State with a linear coastline. The coastline of an island with a small landmass, that might be only a few kilometres, could generate an exclusive economic zone of at least 430 000 sq kms. For a State with a linear coastline to generate the same area that State's coastline would have to be 1165 km long. Indirectly and inversely the landmass of a State could therefore be beneficial in the determination of a maritime boundary.<sup>238</sup>

The International Court has not considered economic or human geography as relevant factors in the initial stages of maritime boundary delimitation. When the delimitation is later assessed for equity, these factors are taken into account.<sup>239</sup> The Court has clearly indicated in a number of instances, however, that delimitation does not seek

*to make equal what nature has made unequal.*<sup>240</sup> and

*there can never be any question of completely refashioning nature, or totally refashioning nature.*<sup>241</sup>

While this has not been definitely stated in judgements, the inference is there.<sup>242</sup>

While land boundaries may be related to geographical features for ease of identification and, in some instances, to ensure the sharing of resources or access, land boundaries usually originate for historic or political reasons. Maritime boundaries are generally totally geographic and are related to the coast or the continental margin.

Where there is a complex coastal geographical configuration, the selection of coastal features for baseline points could vary considerably. Unlike land boundaries the outer limits of territorial or other zones are generated from a baseline or lateral boundary. Changes to the maritime boundary or baseline could affect all zones. If, subsequently, different points are adopted on the coast, it could change the adopted boundaries and limits of the coastal State, a factor not normally associated with land boundaries.

Similarly, when the direction or length of a coast is considered as a factor in delimitation, it can be done either in a micro-geographical or macro-geographical context. The micro option considers the local geo- graphical situation in the area of the delimitation, whereas the macro option takes into consideration the entire coastlines of the States concerned. This was part of the arguments of both the US and Canada in the Gulf of Maine Case<sup>243</sup> where the US argued that the macro option should be considered and Canada the micro. The Court applied the micro option and allocated 284 nm of coastline to the US and 206 to Canada.

When proportionality was determined, the ratio was 1.38 : 1 in the favour of the US.<sup>244</sup> In spite of this, Judge Schwebel, in a separate opinion, felt that not enough consideration was given to the local geography and that the Bay of Fundy should have had a greater effect on the result.<sup>245</sup>

<sup>238</sup> M Thamsborg "In Search of an Objective Approach to the Identification of Certain Geographical Parameters" Nordic Journal of International Law 64 (1995) p665 & 666

<sup>239</sup> Weil n235 p273

<sup>240</sup> Libya/Malta Continental Shelf Case (1985) ICJ Rep 13 para 46

<sup>241</sup> North Sea Continental Shelf Cases n232 para 91

<sup>242</sup> Delimitation of the Maritime Boundary in the Gulf of Maine (Canada/United States) (1986) ICJ Rep 246 334 (paras 237-241)

<sup>243</sup> *ibid*

<sup>244</sup> *ibid* para 221

<sup>245</sup> *ibid* p542

Although it is not stated that a particular option had been employed in a delimitation inferences have been made from the number and extent of the basepoints used. In the delimitations between Norway and the United Kingdom(1965),<sup>246</sup> Netherlands and the United Kingdom 1965<sup>247</sup> and the Federal Republic of Germany and the Netherlands 1964<sup>248</sup> it would appear as if the entire (macro) coast was used. Between Norway and the Soviet Union 1957<sup>249</sup> the micro option was used. In some instances, such as between France and Spain, both were used. The micro option was used to delimit the territorial waters and a macro approach for the rest of the zones.

Coastlines cannot be co-ordinated over their entire length and their positions are usually taken from maps of the coastal State. In recent years, these maps have been made by aerial photographic methods. The scale of the photographs is governed by the height flown by the aircraft. The scale of the subsequent mapping is usually considerably smaller. In Chapter VI the implications of the various survey methods, their results and their effect on delimitation procedures, will be considered.

Geographical features are, however, dependent on mapping for their positioning and in a dynamic zone, such as a coast or continental margin, the effect of the geographical or geological features will depend on the methods of determination. Where parallels of latitude or lines of azimuth were adopted for the delimitation of lateral boundaries, no geographical features were considered.<sup>250</sup>

## PROJECTIONS

To be able to depict the earth's surface on a plane map or chart the most suitable map projection has to be selected. Maps and the projections used in their compilation vary in accuracy and application and are usually best suited to certain areas of the earth's surface or to meet specific requirements. There are essentially three types of projections, Equal Area, Conventional and Conformal.

Each projection endeavours to keep a certain facet of the spherical earth as representative as possible when depicted in a plane format. This will necessitate, therefore, the sacrifice of the accuracy of the depiction of other aspects on the earth's surface.<sup>251</sup>

### Equal Area (Equivalent)

These projections endeavour to reproduce every portion of the earth's surface in a constant area ratio on a map. They have an algorithm that maintains equivalency of area. The projections include Conical, Azimuthal and Cylindrical Equal Area, the Bonne-Werner and maps such as Sinusoidal, Mollweide, Parabolic, Eumorphic, Eckart and Hammer-Aitoff. It is unlikely that any of these projections will have a bearing on aspects of LOSC and are not considered further.<sup>252</sup>

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<sup>246</sup> Norway/United Kingdom (1965) 551 UNTS 213; ND I, p120, Weil n235 p126

<sup>247</sup> Netherlands/United Kingdom 595 UNTS 105 (1967) Protocol 861 UNTS 224 (1973), Weil n235 p126

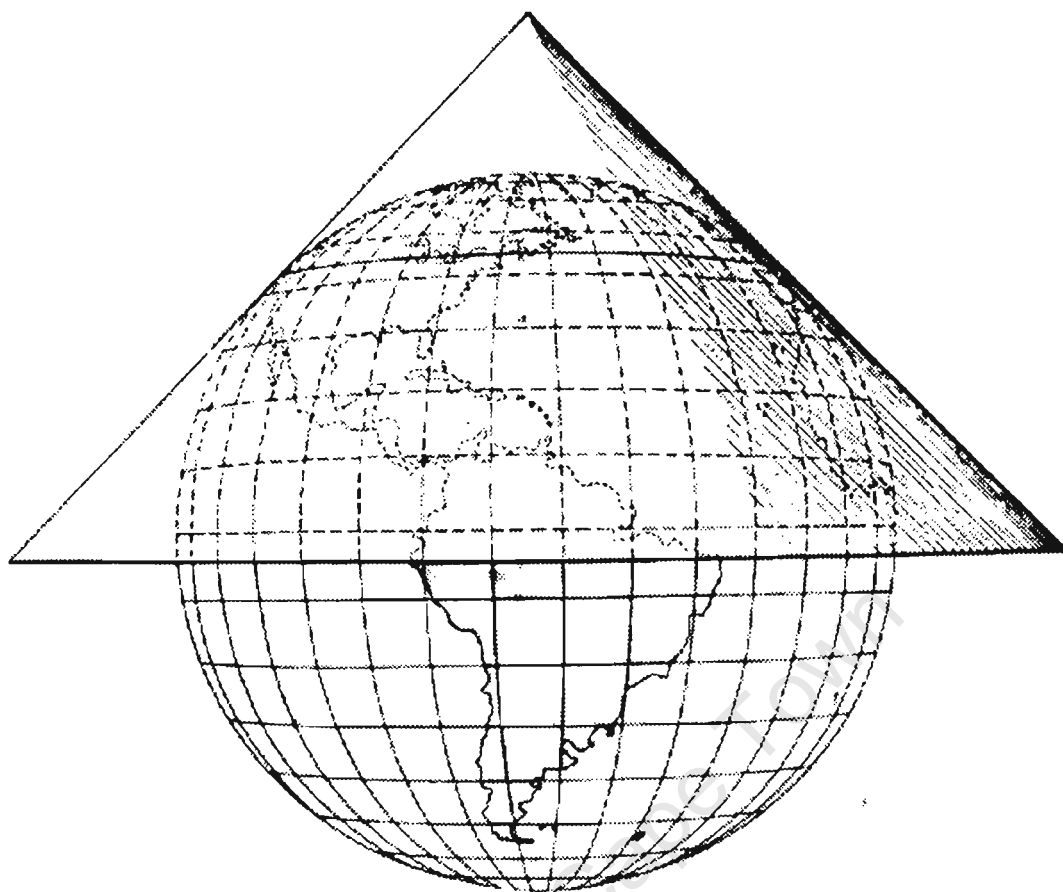
<sup>248</sup> Federal Republic of Germany/Netherlands 550 UNTS 123 (1965), Weil n235 p127

<sup>249</sup> Norway/Soviet Union Limits in the Seas No 17 (1970), Weil n235 p125

<sup>250</sup> Gambia/Senegal Limits in the Seas No85 (1979), Columbia/Ecuador New Directions in the Law of the Sea Vol5(1973-1990) p207

<sup>251</sup> F Pearson II Map Projection Methods (1984) p11 and 91

<sup>252</sup> *ibid* p113-137



**Figure 5 A SIMPLE CONIC PROJECTION**

### **Conventional**

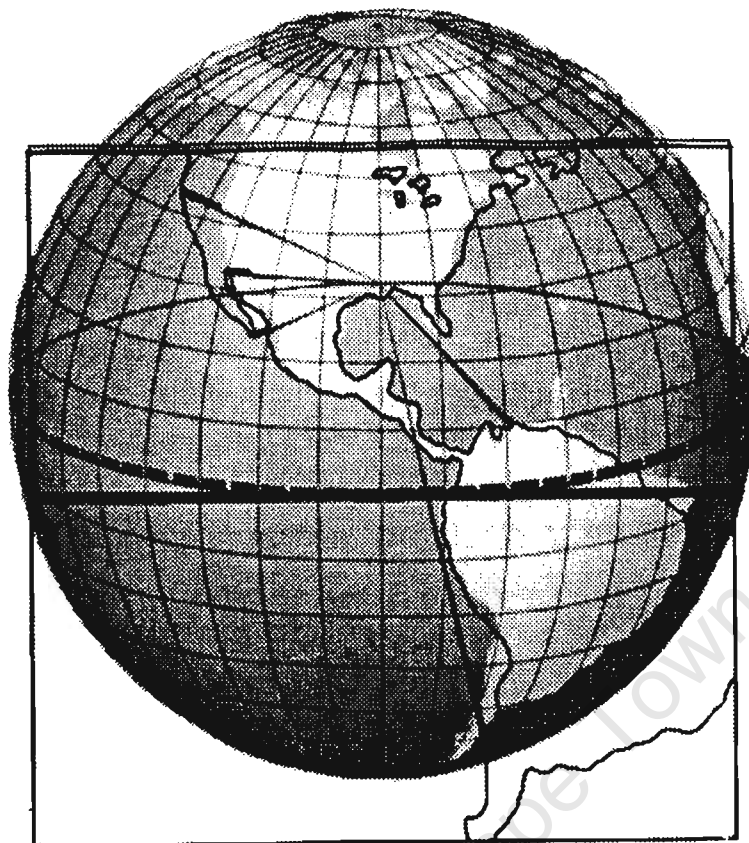
There are projections that do not fall into either of the other two categories. They are projections developed to preserve a particular aspect of the earth's surface for the special needs of certain disciplines. Included in this category are the Gnomonic, the Azimuth Equidistant and the Polyconic. Of historical interest only are the Van der Grinten, Plate Carree, Curte Parallelogrammatique, Gall Murdock, Cassini and the Stereographic of Clark, James and La Hine.<sup>253</sup> The most effective of these projections is the gnomonic which depicts all great circles as straight lines.

### **Stereographic**

*Stereographic projections result from projecting points on the earth's surface onto a plane that is tangential to the earth. They are projected from a point opposite the point of tangency. The projection is also called an 'azimuthal orthomorphic projection'.*<sup>254</sup>

<sup>253</sup> Pearson n249 p239-254

<sup>254</sup> Bowditch n194 p30



**Figure 6 AN EQUATORIAL STEREOGRAPHIC PROJECTION**

#### **Conformal**

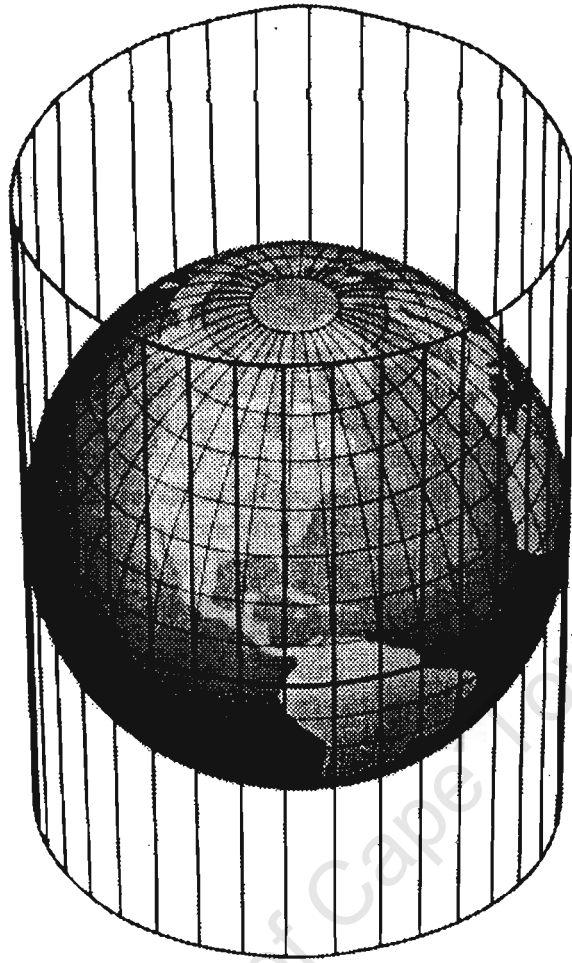
These projections maintain the shape of a portion on the earth's surface and the orthogonal system of parallels and meridians on the ellipsoid or sphere appear as an orthogonal system on the map. The three major projections in this category are the Mercator, Transverse Mercator, Lambert Conformal and Stereographic. The Mercator conformal cylindrical projections are considered the most accurate at equatorial latitudes, the Lambert at middle latitudes and the Stereographic in polar regions.<sup>255</sup>

In the case of the Mercator projection all angles from a point are correctly represented and a straight line on this projection will cut all meridians and parallels at the same angle as a loxodrome, which will spiral up to but not reach a pole. The best approximation of the shortest distance between two points on the earth's surface is the arc with a centre near the earth's centre and which passes through both points. This arc is known as the great circle and is represented as a curved line on a Mercator projection.

As maps and charts, based on conformal projections, are usually the ones that are used to depict delimitation they are considered in greater detail.

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<sup>255</sup> ibid p24



**Figure 7 A CYLINDRICAL PROJECTION**

### **Conical and Cylindrical**

Conical or Cylindrical projections are related to the earth by coinciding a line on the map with a circle on the earth's surface that could be a circumference or a small circle.

The three possibilities are;<sup>256</sup>

- a) Regular : where the axis of the cone coincides with the polar axis of the earth and the circle of contact coincides with a line of latitude (conical) or the equator (cylindrical);
- b) Transverse : where the circle of contact is at right angles to the earth's polar axis;
- c) Oblique: where the circle of contact is on any other circle than as described in 1) or 2).<sup>257</sup>

It is also possible to have two circles of contact where the plane of the projection cuts the earth's surface. This is known as a secant projection and where it touches only once, it is called tangential.

It will be seen that the most contact that can exist between the projection and the earth's surface is a point on one or two circles. The balance of the projection is a compromise to allow for the earth's surface to be recorded in a plane format.<sup>258</sup> The Mercator projection is the classic cylindrical projection devised in 1569 by Gerhard Kramer (Mercator).

<sup>256</sup> ibid p26/27

<sup>257</sup> ibid

<sup>258</sup> ibid 24-29

It was produced to facilitate navigation in the early days of exploration and it has been in constant use for this purpose up to the present day.<sup>259</sup>

As the Mercator projection is a cylindrical projection it will be seen that all the lines of longitude are shown as being equally spaced throughout their length whereas on the earth's surface the meridians converge at the poles. For this reason, when this projection is used a mid-latitude is chosen for the area to be charted, to ensure that distortions are evenly distributed over the map. Early navigators did not often venture into polar regions and as this projection best serves mariners in equatorial regions it has been, and still is, particularly popular. It remains the main projection for nautical charting in these areas up to present times. As the projection radiates from a particular line of latitude, the distances between the parallels of latitude will increase in the direction of the poles and this becomes excessive and unacceptable beyond 60 north or south.

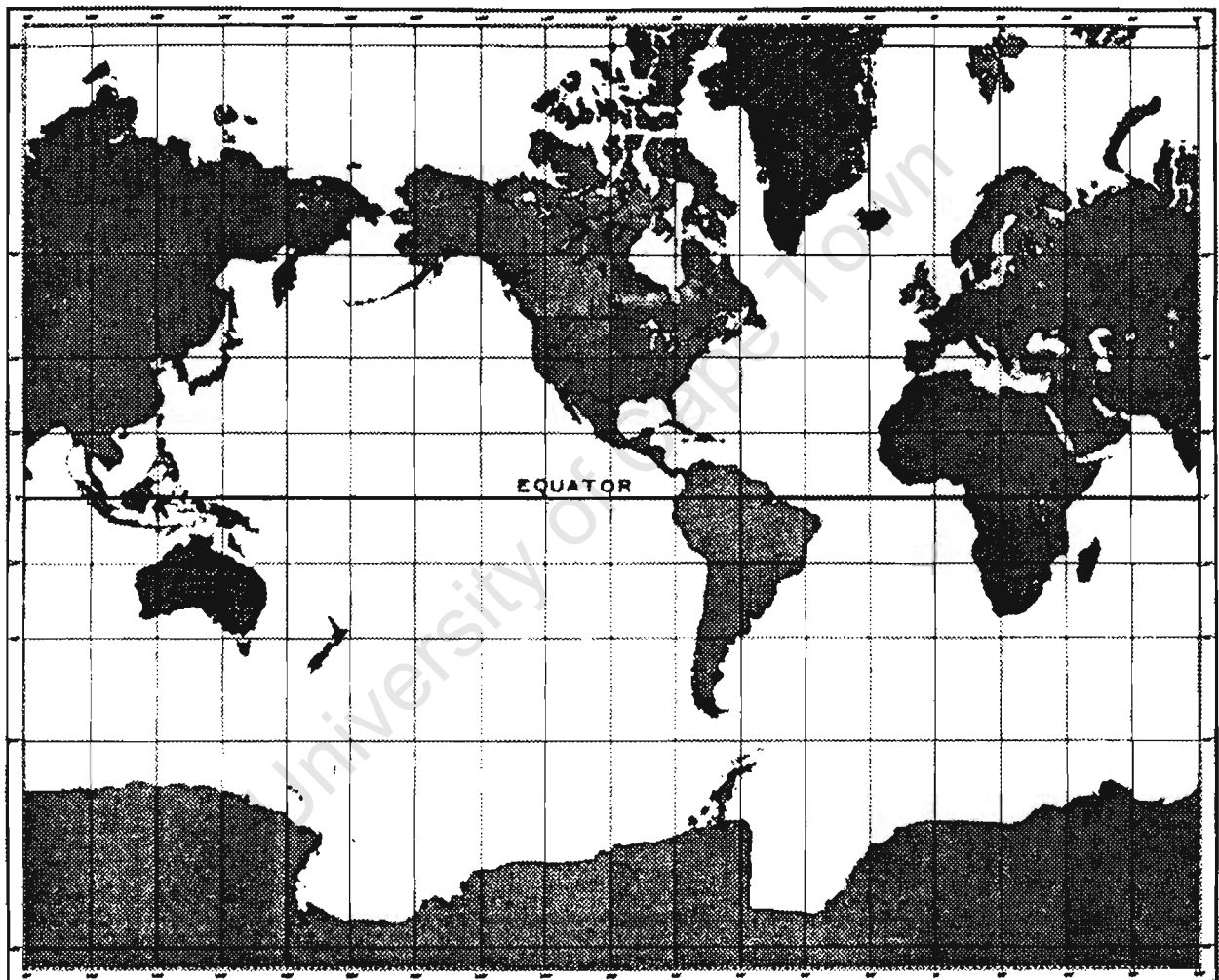


Figure 8 A MERCATOR MAP OF THE WORLD

Transverse Mercator and Lambert Conformal projections are utilised for modern topographical mapping and Oblique Mercator projections have been used as space-capsule recovery charts for the Mercury, Gemini and Apollo space programmes, where the circle of contact approximates to the re-entry path of the satellite.<sup>260</sup>

<sup>259</sup> Pearson n249 p164

<sup>260</sup> ibid

The Mercator chart requires two mathematical transformations. The first would be from the ellipsoid to the conformal sphere and the second from this sphere to the plane map surface.

It is necessary therefore to derive plotting equations, which will allow the transformation of a position on the earth's surface, with values expressed in degrees of latitude and longitude, to cartesian co-ordinates on a chart or map. The ability to transform cartesian co-ordinates to latitude and longitude is also obviously a requirement.<sup>261</sup>

University of Cape Town

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<sup>261</sup> ibid p239

## COMMENTED GLOSSARY OF TERMS RELEVANT TO GEOGRAPHY USED IN LOSC

(Unless otherwise stated all definitions are taken from AJ Kerr, NR Guy et al IHO Manual on Technical Aspects of United Nations Convention on Law of the Sea 1982 3rd Ed 1993.)

Many of the geographical terms featuring in LOSC are in common usage but it is essential that where a particular definition is intended in the Convention misinterpretation does not occur.

### ARCHIPELAGO <sup>262</sup>

*...means a group of islands, including parts of islands, interconnecting waters and other natural features which are so closely interrelated that such islands, waters and other natural features form an intrinsic geographical, economic and political entity, or which historically have been regarded as such.*

#### Comment

This definition is used in LOSC and is far more specific than the definitions that are normally given which could be as vague as;

*...a body of water interspersed with isles; a group of islands.* <sup>263</sup>

### ARCHIPELAGIC STATE AND WATERS

*a) 'archipelagic State' means a State constituted wholly by one or more archipelagos and may include other islands.* <sup>264</sup>

*b) The sovereignty of an archipelagic State extends to the waters enclosed by the archipelagic baselines drawn in accordance with Article 47, described as archipelagic waters, regardless of their depth or distance from the coast.* <sup>265</sup>

#### Comment

Archipelagic States and archipelagic waters have been given particular consideration in LOSC. Some archipelagos consist of hundreds of islands spread over vast areas of an ocean. To be able to draw archipelagic baselines and enclose archipelagic waters the relevant Articles of LOSC must be complied with.

- a) Archipelagic baselines may be drawn from positions on the low-water line of the outermost points of islands or their drying reefs provided that the ratio of the water area enclosed by these baselines to the land area, including atolls, is between 1:1 and 9:1. <sup>266</sup> Land areas may include waters lying within fringing reefs and atolls, that part of steep-sided oceanic plateaux which are enclosed or nearly enclosed by chains of limestone islands and drying reefs lying on the perimeter of a plateau.
- b) Baselines may not be drawn to low-tide elevations unless permanent above-water structures, such as lighthouses, have been constructed on them or they are within 12 nm of the baselines from which the territorial sea is measured. <sup>267</sup>

<sup>262</sup> LOSC Article 46(b)

<sup>263</sup> A M Williams et al (eds) *The Kings English Dictionary* (1930) p48

<sup>264</sup> LOSC Article 46(a)

<sup>265</sup> LOSC Article 49(1)

<sup>266</sup> LOSC Article 47(1)

<sup>267</sup> LOSC Article 47(4)



- c) Baselines may not exceed 100 nm in length except for 3% of the total number, which may not exceed 125 nm.<sup>268</sup>
- d) Baselines must conform to the general configuration of the archipelago.<sup>269</sup>
- e) Baselines may not cut off high seas, exclusive economic zones or territorial waters of another State.<sup>270</sup>

Archipelagic waters are those waters contained landwards of archipelagic baselines. As these waters could be extensive and include waters that were previously used as international sea-trade routes, the rights of the archipelagic State in these waters is not as comprehensive as in internal waters.<sup>271</sup>

#### ATOLL<sup>272</sup>

*A ring shaped reef, with or without an island situated on it, surrounded by the open sea, that encloses or nearly encloses a lagoon.*

#### Comment

LOSC requires that the ratio of the water area enclosed by an archipelago to the land of the islands should be in the range of 1:1 to 1:9. Where atolls are included in the archipelago, the water enclosed in the atolls may be included in the area of water.

#### BANK.

*A submarine elevation located on a continental margin over which the depth of water is relatively shallow.*

*It is that portion of land that confines a river.*

#### Comment

The submarine bank, with other submarine features named in LOSC, is excluded from the restriction of a maximum of 350 nm from the territorial sea baselines. This restriction is imposed when determining the outer limits of the continental shelf.<sup>273</sup> The position of the low-water line on the banks at the mouth of a river is important for the drawing of a straight baseline across the mouth. The configuration of the bank at the mouth of a river in relation to the low-water line there determines the position from which a straight baseline commences or ends.<sup>274</sup>

#### BAY (Juridical)<sup>275</sup>

*For the purposes of the Convention, a bay is a well marked indentation whose penetration is in such proportion to the width of its mouth as to contain landlocked waters and constitutes more than a mere curvature of the coast. An indentation shall not, however, be regarded as a bay unless its area is as large as, or larger than, that of the semi-circle whose diameter is a line drawn across the mouth of that indentation.<sup>276</sup>*

<sup>268</sup> LOSC Article 47(2)

<sup>269</sup> LOSC Article 47 (3)

<sup>270</sup> LOSC Article 47(5)

<sup>271</sup> LOSC Articles 49 & 53

<sup>272</sup> LOSC Articles 6, 47(1),(7)

<sup>273</sup> LOSC Article 76(6)

<sup>274</sup> LOSC Article 9

<sup>275</sup> LOSC Articles 10(6) and 298(1)(a)(i) and Convention on the Territorial Sea and the Contiguous Zone (1958) Article 7(6)

<sup>276</sup> LOSC Article 10 (2)

## Comment

Both LOSC and the 1958 Convention on the Territorial Sea and the Contiguous Zone refer to so-called 'historic bays. Although the UN produced a report on the juridical nature of historic bays the only international acceptance of the concept is in customary law.<sup>277</sup> Special consideration has been given in LOSC to possible disputes that could arise out of claims to historic bays. These dispute mechanisms include the requirement for the States to submit to conciliation under Annex Section 2. This Section excludes disputes over sovereignty and other disputes over continental or insular land territory. As historic bays do not have specific geographical features they have been considered in greater detail in Chapter XI as claims to traditional rights.

## BAY (Mouth)<sup>278</sup>

As the closing line of a bay is across the 'mouth' of the bay, between natural entrance points determined on the low-water line on either side of the bay, the mouth of the bay must be coincident with the closing line.

The identification of 'natural entrance points' of bays is, usually, complicated as they must be the low-water-line and they must be clearly identifiable as being the points at which the general coastline changes to form the bay. In Post Office v Estuary Radio<sup>279</sup> the Court had to decide whether the Thames Estuary was legally a bay. The litigants submitted evidence for the adoption of different points on the coastline for this purpose. The Court of Appeal ruled in favour of the Post Office, but comment has been expressed that none of the points identified could be regarded as natural entry points.<sup>280</sup> The importance of correctly establishing both the natural entry points and the position of the low-water-line is, therefore, well illustrated.

## CAP<sup>281</sup>

*A submarine feature with a rounded cap-like top. Also defined as a plateau or flat area of considerable extent, dropping off abruptly on one or more sides.*

## Comment

This submarine feature is relevant when the outer limits of a continental shelf claim are being determined. It is regarded as an integral part of a continental margin along with banks, spurs, rises and plateaux. Similarly to the geographical feature 'banks', this feature is excluded from the restriction of 350 nm from territorial sea baselines as an outer limit for a continental shelf claim.

## COAST

*The edge or margin of land next to the sea.*

## Comment

LOSC refers to coasts as 'opposite or adjacent' and the term 'coast' does not appear to have significance on its own. It should be noted that the Articles referring to the coast of a State deal with the delimitation of either lateral boundaries between States or the outer limits of a State's maritime zones and should therefore be read in conjunction with those Articles dealing with baselines.

<sup>277</sup> United Nations Office of Ocean Affairs and Law of the Sea Publication (DOALOS) Bays (1989)

<sup>278</sup> LOSC Article 10(2)(3)

<sup>279</sup> Post v Estuary Radio 1968 2QB 740

<sup>280</sup> Churchill n18 p32, O'Connell n47 p57

<sup>281</sup> LOSC Article 76(6)

## Adjacent Coasts.<sup>282</sup>

*The coasts lying either side of the land boundary between two adjoining States*

### Comment

Adjacent coasts require a delimitation of the seaward boundary between them. This would commence at the coastal terminal of the agreed land boundary between the States and would be projected seawards by a number of methods, including but not limited to;

- a) an agreed line of azimuth from the coast;
- b) an agreed line of latitude;
- c) the determination of a line based on the principal of equidistant.<sup>283</sup>

Geodetic complications can occur when employing options a) and b) because a line of azimuth, bearing, or line of latitude would have to be geodetically computed and this line would not be easily put into everyday practical use. In addition the terminal of the land boundary may not be computed to be in the same position as the commencement position of the sea boundary even though they are theoretically the same. In the case of option c) any point on the boundary must be at an equal distance from the nearest point on the coasts of the two States. This must also be geodetically computed.

## Opposite Coasts.

*The geographical relationship of the coasts of two States facing each other.*

### Comment

Although LOSC requires that States, who fail to agree on the delimitation of lateral and median line boundaries of territorial seas, should adopt an equidistant line<sup>284</sup> it does make provision for other methods to be considered.<sup>285</sup>

Equidistant and median lines have been used in delimitation settlements, including the following:

Bahrain/Saudi Arabia 1958,<sup>286</sup>

Iran/Qatar 1969<sup>287</sup>

Iran/Bahrain 1971<sup>288</sup>

Iran/Oman 1971<sup>289</sup>

Italy/Tunisia 1971<sup>290</sup>

<sup>282</sup> LOSC Articles 15, 74(1), 76(10), 83(1), 134(4), A2/9

<sup>283</sup> N R Guy The Lateral and Vertical Limits of a Hypothetical Republic of South Africa Continental Shelf according with International Law and in Particular Articles 76, 83 and 84 of the UN Law of the Sea Convention (1990) p43-52

<sup>284</sup> LOSC Article 15

<sup>285</sup> *ibid*

<sup>286</sup> New Directions in the Law of the Sea Vol 5 (1973-1990) p207

<sup>287</sup> *ibid* p212

<sup>288</sup> *ibid* p214

<sup>289</sup> *ibid* p216

<sup>290</sup> *ibid* p223

Italy/Spain 1974 <sup>291</sup>  
Columbia/Costa Rica 1977 <sup>292</sup>

Columbia/Panama 1977 <sup>293</sup>

Columbia/Haiti 1977 <sup>294</sup>

United Kingdom/France 1979 <sup>295</sup>

The median line, computed in the English Channel, between these two countries was done by using the equidistant method. A half-effect was accorded the Scilly Isles, and 12 nm enclaves were computed around the Channel Islands. Half-effect is the position adopted after the situation is considered with, and without, the presence of an island in delimitation. The mean of these two possibilities is then adopted.

Tunisia/Libya, 1982 <sup>296</sup>

A similar position was adopted by the Court in the delimitation of the lateral boundary between Libya and Tunisia. In this Case, half-effect was accorded to the Tunisian islands of Juzur Qarqannah.

United States/Canada 1984 <sup>297</sup>

In the Gulf of Maine Case additional factors were considered when the Court decided on a boundary. Although the Court dismissed the equidistant line draw by Canada, it did adopt a median line, which was influenced by giving Seal Island half-effect. The balance of the boundary was determined using other factors, such as, the lengths of the coasts of the States being compared and used as a ratio. <sup>298</sup>

Libya/Malta 1985 <sup>299</sup>

In this Case the Court adopted an equidistant median line between Malta and Libya but then adjusted this line northwards, away from Libya, towards Malta, to compensate for the disparity in the lengths of their respective coastlines.

Burma/India 1987 <sup>300</sup>

South Africa/Mozambique 1995 <sup>301</sup>

This boundary has been computed using the equidistant method, but it has not, as yet, been agreed to.

Two additional aspects contained in LOSC that have a bearing on the determination of either straight baselines or the equitable delimitation of territory or resources, are the following.

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<sup>291</sup> *ibid* p226

<sup>292</sup> *ibid* p230

<sup>293</sup> *ibid* p235

<sup>294</sup> *ibid* p242

<sup>295</sup> Anglo/French n167 ( ILM 16 (1977) 9397 and ILM 20 (1981) p797)

<sup>296</sup> Tunisia/Libya n 234

<sup>297</sup> Gulf of Maine Case n240

<sup>298</sup> *ibid* p277 para 221

<sup>299</sup> Libya-Malta n238

<sup>300</sup> Burma/India 27 ILM 1144 (1988)

<sup>301</sup> ( As verbally advised by the Director Control Surveys, Surveys and Land Information, South African Department of Environment Affairs) (March 1997)

### General Direction of the Coast/ Length of the Coast<sup>302</sup>

Both of these aspects received consideration in the Gulf of Maine Case.<sup>303</sup> Included in the arguments of both States were submissions that the lateral boundary should reflect the direction of the coast. The US that this was the primary coast of North America and Canada submitted it was the more local direction of the coast in the Gulf.

The judgement of the Chamber of the International Court of Justice rejected both arguments.<sup>304</sup>

Schneider notes;

*The Chamber, of course, also noted that the delimitation was not to be limited to the inner Gulf of Maine. It rejected, however, attempts of both parties to involve coasts other than those directly surrounding the Gulf, insofar as they would have the effect of extending the delimitation area to maritime areas, which have nothing to do with it.*<sup>305</sup>

The lengths of the coasts accepted by the Chamber were 284 nm for the US and 206 nm for Canada. This resulted in a ratio of 1.38 to 1 being applied in the delimitation.<sup>306</sup>

### CURRENTS

A major factor in some exclusive economic zones, and continental margins, could be the presence of fast or large-volume currents. Historically this would have affected the configuration of the margin, the amount and type of sediment, and the deposition of resources in the area. The type and movement of mobile resources could also be affected by a current of this nature. In the Southern Indian and Atlantic Oceans the major currents are the Mozambique, South Equatorial, East Madagascar, Agulhas, Benguela, Antarctic Circumpolar or West Wind Drift<sup>307</sup> and the Angola Current which is seasonal.

Circulation of the seawater is due mainly to two factors. The density of the water is partly caused by its movement. Wind stress has a major influence on the surface water. Oceanic circulation is the way by which waters of different salinity and temperature are distributed throughout the oceans.<sup>308</sup>

*The forcing for the flow may come from the surface wind stress (the frictional term in the momentum equation) or from surface buoyancy fluxes, arising from heat and fresh water (precipitation-evaporation) exchange with the atmosphere. These buoyancy fluxes change the temperature and salinity in the surface of the ocean. However, the horizontal and vertical flow carry these properties far into the interior of the oceans, where they tend to mix with other masses.*

*This process of transport and mixing is described by the temperature and salinity equation. From these two equations, the seawater density and thence the pressure can be obtained.*<sup>309</sup>

*Because of the differences of density in the seawater, resulting from variations in temperature and salinity, it cannot remain immobile, but is forced to move in sympathy with these density variations.*<sup>310</sup>

<sup>302</sup> LOSC Article 7(3)

<sup>303</sup> D R Robinson et al "Some Perspectives on Adjudication before the World Court: The Gulf of Maine Case" AJIL Vol 79 (1985) p578/579

<sup>304</sup> Gulf of Maine Case n240 p299-300 para 112

<sup>305</sup> J Schneider "Gulf of Maine : An Equitable Result" AJIL Vol 79 (1985) p567

<sup>306</sup> *ibid* p572

<sup>307</sup> R Kunzig Mapping the Deep (1999) p269

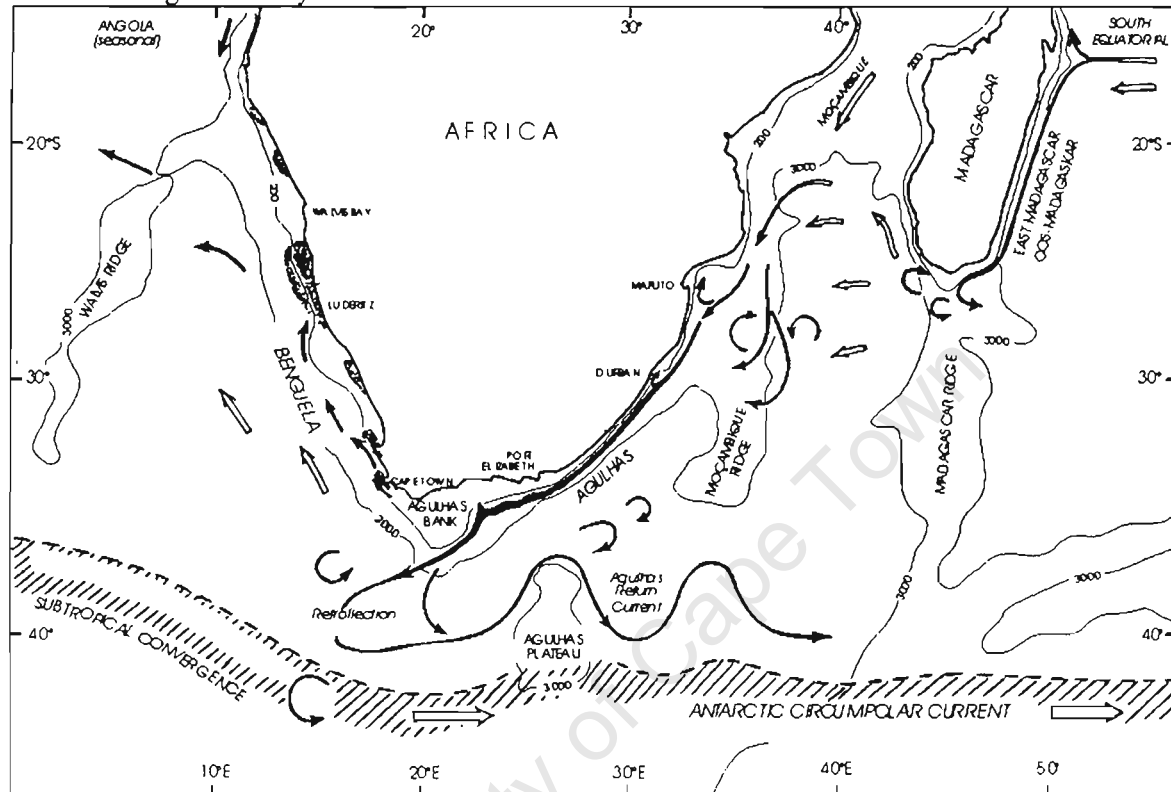
<sup>308</sup> CAM King Oceanography for Geographers (1962) p115

<sup>309</sup> NC Wells, WJ Gould & AES Kemp " The Role of Oceans Circulation in the Changing Climate" in Oceanography: An Illustrated Guide CF Summerhayes & SA Thorpe (eds) (1996) p52

<sup>310</sup> King n306 p115/116

*Although the wind plays a very important part in the surface current pattern, at least in some areas it has been suggested that the thermohaline density factors cause the surface gradients; these in turn may influence the wind field to some extent.*<sup>311</sup>

Wind affects the sea surface causing direct surface drift equivalent to approximately 3% of the wind speed. This effect decreases with depth but a substantial deep-water flow develops as a result of the waves that are generated by the wind.<sup>312</sup>



**Figure 9 SOUTHERN AFRICAN AND CIRCUMPOLAR CURRENTS**

The rotation of the earth causes the Coriolis Force, which diverts currents to the left in the Southern Hemisphere and to the right in the Northern Hemisphere. The major wind belts are responsible for the development of anticlockwise gyres in the southern Indian and Atlantic Oceans. In the Southern Hemisphere the Coriolis Force results in currents that are far stronger on the western sides of the oceanic basins. This is reflected in the comparative strengths of the Agulhas Current, which travels polewards in a south westerly direction on the western side of the South Indian Ocean Basin, and the weak, ill-defined Benguela Current which moves, towards the equator, in a northerly direction on the eastern side of the South Atlantic Ocean Basin.<sup>313</sup>

### South Equatorial and Mozambique Currents

The Mozambique Current is generated by the South Equatorial Current dividing as it approaches the East African coast. The portion diverted to the south becomes the Mozambique Current and the remainder becomes the East African Coastal Current, which flows, in a northerly direction. The South Equatorial Current is the northern portion of the anticlockwise South Indian Ocean gyre. The South Equatorial Current is also responsible for the formation of the East Madagascar Current, which is the portion that is, diverted southwards by the East Coast of Madagascar. These currents are surface

<sup>311</sup> ibid

<sup>312</sup> E Schumann "Low Frequency Fluctuations Off the Natal Coast" *Journal of Geophysical Research* Vol 86 p6499, E Schumann *South African Sailing Directions* Vol 1 (1994) p3-34

<sup>313</sup> ibid p3-34

currents that are usually located at an approximate depth of 200 metres, near the shelf break. The speeds of the currents vary between 0.5-2 knots.<sup>314</sup> A confluence of the various currents occurs at the southern end of the Mozambique Channel and recently a current, that runs periodically on the eastern side of the Mozambique Ridge, has been discovered.

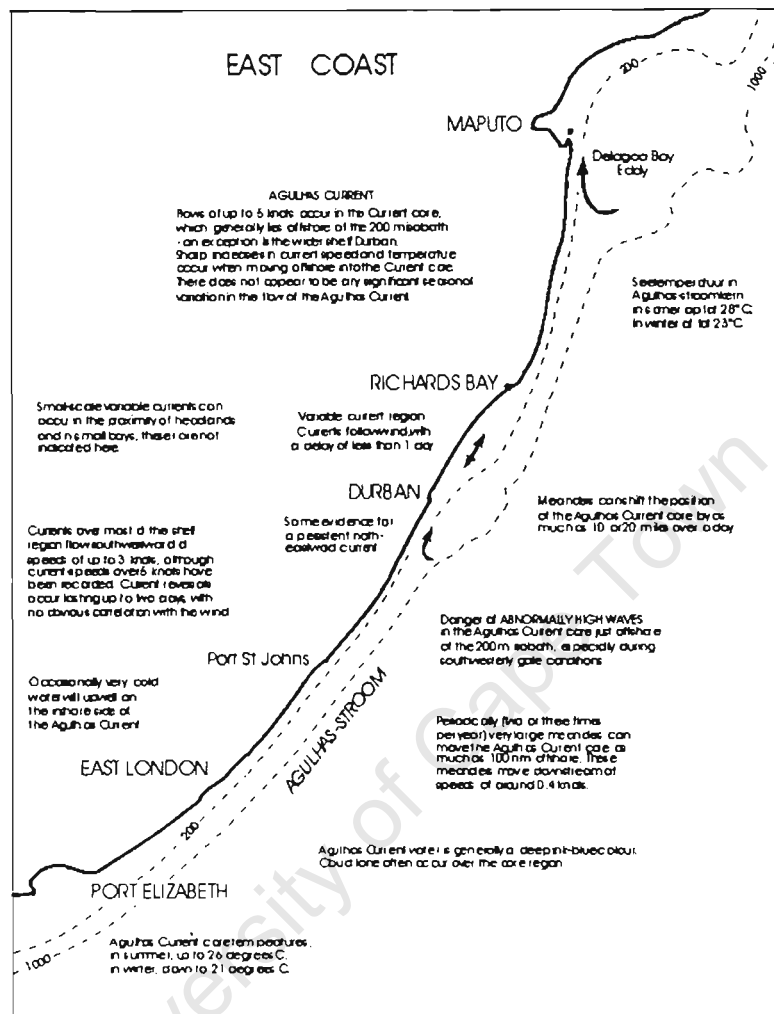


Figure 10 THE AGULHAS CURRENT ON THE SOUTHEAST COAST OF AFRICA

### Agulhas Current

This current is one of the strongest currents in the world<sup>315</sup> and is thought to originate over a broad area at approximate latitude 25 degrees south. It gathers speed as it moves along the edge of the continental shelf until it reaches its maximum speed at about latitude 33 degrees south.<sup>316</sup> The current is easily identified by its sea surface temperature. The core temperature of the Natal coast can reach as high as 28 degrees Celsius dropping by about 3 degrees as it travels in a south westerly direction. Plumes from the current extend over the shelf, on top of the colder water, and temperatures, lower than the core temperature in the area have been recorded.<sup>317</sup>

At latitude 33 degrees south, a major development occurs in that the current sweeps in a southerly direction until it joins the eastward-flowing Southern Ocean Current. At the position where it turns

<sup>314</sup> ibid p3-37

<sup>315</sup> ibid p3-34

<sup>316</sup> ML Grundlingh "Agulhas Current Meanders: Review and Case Study" *South African Geographical Journal* (1992) 74 p19, ML Grundlingh "Drift of a Satellite-Tracked Buoy in the Southern Agulhas Current and Agulhas Return Current" *Deep Sea Research* Vol 25 (1978)

<sup>317</sup> Schumann n310 p3-30,31

south, clockwise- turning rings form and move in a northwesterly direction. These rings have been known to travel up the West Coast of southern Africa for considerable distances. The area where these relatively warm water rings travel usually has the cold Benguela Current travelling slowly in the same direction. The Agulhas Current is thought to be variable to the extent that it has been known to change its position by up to twenty miles in a day. This is thought to be as a result of eddies set up by the current and formed between the coast and the current.<sup>318</sup>

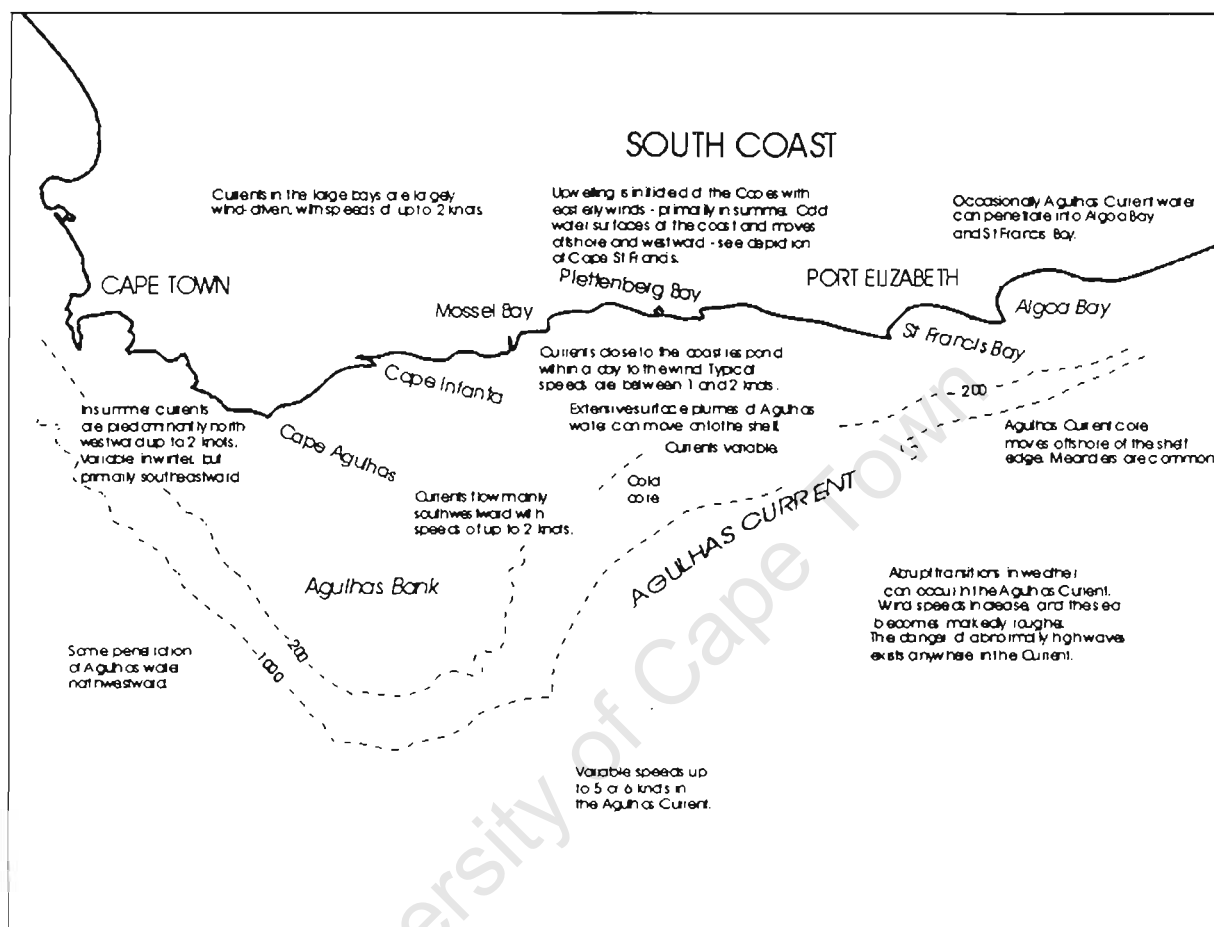


Figure 11 THE AGULHAS CURRENT ON THE SOUTH COAST OF AFRICA

### Benguela Current

This current is a gentle equatorial movement of water up the West Coast of southern Africa formed on the eastern side of the anticlockwise gyre of the South Atlantic Ocean Basin. Although there are smaller-scale variations the general speed of this current between Cape Town and Cape Frio in northern Namibia is about 0,3 kms.<sup>319</sup> This current is thought to originate as a result of the upwelling of the cold bottom current against the continent. It brings with it nutrients that are an essential food source for the major fish resources in the area.<sup>320</sup> Upwelling is caused also by offshore wind driving the surface water seawards thus causing the colder deeper water to rise to the surface. Similarly downwelling is caused by onshore wind causing the surface water to move onto the coast.<sup>321</sup>

<sup>318</sup> ibid p3-37, ND Bang & AF Pierce "Physical Oceanography: Ecology of the Agulhas Current Region. An Assessment of the Biological Responses to Environmental Parametres in the South West Indian Ocean" *Transactions of the Royal Society of South Africa* No 43 Part2 (May 1978)

<sup>319</sup> ibid p3-38

<sup>320</sup> JRE Lutjeharms, FA Shillington, and CM Duncombe Rae "Observations of Extreme Upwelling Filaments in the Southeast Atlantic Ocean" *Science* Vol 253 (August 1991) p774-776

<sup>321</sup> Schumann n310 p3-39



The Walvis Ridge is a submarine ridge that extends in a southwesterly direction from the coast of Angola and marks the boundary of the Benguela and the Angola current systems.<sup>322</sup>

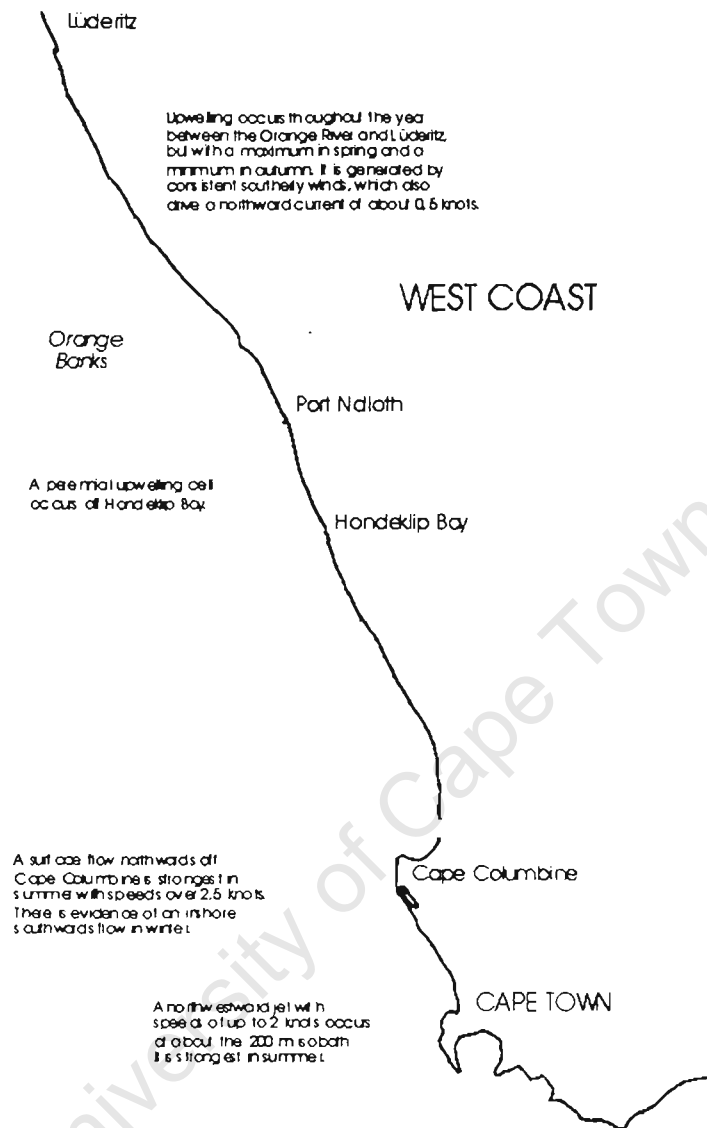


Figure 12 CURRENTS ON THE SOUTHWEST COAST OF AFRICA

#### Comment

Currents play a vital role in the development and distribution of the mobile resources of an area. Plankton, phytoplankton or zooplankton are carried passively by the currents and are the source of food for much of the marine life. Plankton can be translated from the Greek as

*that which is made to drift.*<sup>323</sup>

Whereas the phytoplankton are minute plants that depend on nutrients in the water to develop, zooplankton are minute creatures that feed on the phytoplankton. The zooplankton, in turn, is the main source of food to some species of fish such as pilchards and anchovies.

<sup>322</sup> ibid p3-38

<sup>323</sup> King n306 p265

It will be shown in Chapter VI that currents have a marked effect on the shape, extent, and position of a beach area. The type and activities of currents off the coast of a State, and therefore, could have a significant role in the determination of zones and the extent of the resources of a coastal State.

## **DELTA**<sup>324</sup>

*A tract of alluvial land enclosed and traversed by the diverging mouths of a river.*

*Deltas consist of a complex of distributary channels, natural levees bordering the channels, and shallow lakes or swamps lying between them at a slightly lower level....A major phenomenon in delta evolution is the shifting course of the river into successive distributaries, which may lead to the building of successive sub-deltas.*<sup>325</sup>

### **Comment**

LOSC makes provision for the fact that deltas tend to be unstable and allows for the outer limits of a delta to be co-ordinated. Should the delta increase seawards the co-ordinates may be revised to reflect the new positions. Should the delta decrease landwards the limits may remain at the original position. The coastal State is expected, however, to redefine the outer limits should the delta stabilise at the inner position.<sup>326</sup>

## **ENCLOSED SEA**<sup>327</sup>

*For the purposes of this Convention, 'enclosed' or 'semi-enclosed' sea means a gulf, basin, or sea surrounded by two or more States and connected to another sea or the ocean by a narrow outlet or consisting entirely or primarily of the territorial seas and exclusive economic zones of two or more coastal.*

## **ESTUARY**<sup>328</sup>

*The tidal mouth of a river, where the seawater is measurably diluted by the fresh water from the river.*

### **Comment**

LOSC provides for a river, that flows directly into the sea, to be closed by straight baselines between the natural entry points on the low-water-line on either side of the mouth. The length of a straight baseline is not limited by LOSC. No provision is made in LOSC for estuaries.

As very few rivers flow directly into the sea the closing of most river mouths with straight lines in open to varying interpretation. Uruguay and Argentina have closed the mouth of the River Plate with a straight baseline 120 nm long. In addition Venezuela has a closing line of 99 nm across the mouth of the Orinoco River and Burma has a similar line 222 nm long across the mouth of the Sittang River.<sup>329</sup> If the mouth of the river had been regarded as a bay, which is perhaps more geographically and geologically correct, this bay could not have been closed as more than one State borders the bay and the closing line would exceed 24 nm.<sup>330</sup> These closing lines have not been internationally accepted.

<sup>324</sup> LOSC Article 7(2)

<sup>325</sup> MN Hill *The Sea* Vol 3 (1963) p629-630

<sup>326</sup> ED Brown *The International Law of the Sea* Vol 1 Introductory Manual (1994) p27, Churchill n18 p39

<sup>327</sup> LOSC Article 70(2), 122, 123

<sup>328</sup> LOSC Articles 1(1)(4), 207(1)

<sup>329</sup> United Nations Office for Ocean Affairs and the Law of the Sea (DOALOS) Pub *The Law of the Sea, Baselines: National Legislation with Illustrative Maps* (1989) p383, 66

<sup>330</sup> Churchill n18 p33-39

## HARBOUR WORKS<sup>331</sup>

*Permanent manmade structures built along the coast which form an integral part of the harbour system such as jetties, moles, quays or other port facilities, coastal terminals, wharves, breakwaters, sea walls, etc.*

### Comment

LOSOC provides for the outermost parts of harbour works to be included, as part of a States coast and the low-water-line on such works would be considered as part of the States normal baselines. Any seaward extension of harbour works that comply with Article 11 could extend that coastal States maritime zones seaward. The entrances to harbours may be closed with a closing line and the waters inside the harbour are then regarded as internal waters.

## INSTALLATION (Off-Shore)<sup>332</sup>

*Manmade structure in the territorial sea, exclusive economic zone or on the continental shelf usually for the exploration or exploitation of marine resources. They may also be built for other purposes such as marine scientific research, tide observations, etc.*

### Comment

The installation is regarded as territory of the coastal State and the national laws of that States are applicable on the installation. Installations are not considered as islands or low tide elevations and may not, therefore, generate any maritime zones. The only zone that may be applied is a safety zone that may not exceed 500 metres measured in any direction, including vertically, from the outer edges of the installation. If at any stage an installation is abandoned or becomes disused it must be removed, taking into consideration accepted international standards applicable to its removal.

## ISLANDS<sup>333</sup>

*An island is a naturally formed area of land, surrounded by water, which is above water at high tide.*<sup>334</sup>

### Comment

Islands can be divided into a number of categories;<sup>335</sup>

- a) islands that are an integral part of a continental State and fall within the coastal States territorial waters;
- b) islands that are part of the territory of a continental State and fall outside that States territorial waters and in particular those that are distant from the State;
- c) islands that may be part of the territory of a continental State or an independent State but are close to the coast or the zones of another State;
- d) islands that may or may not be independent but are situated on an oceanic ridge or plateau;

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<sup>331</sup> LOSC Article 11

<sup>332</sup> LOSC Articles 1(1)5, 7(4), 11, 19(2)(k), 21(1)(b), 47(4), 51(2), 59(1)(b)(i), 60, 62(5), 79(4), 80, 87(1)(d), 94(7), 111(2), 145(a), 137(2), 153(5), 180, 194(3), 208(1), 209(2), 211(3), 214, 216(1)(c), 218(3), 219, 220(1), 246(5), 249(1), 258, 259, 260, 261, 262, A6/30(4)

<sup>333</sup> LOSC Articles: 6, 7(1), 10(2) (3) (4) (5), 13, 38(1), 46, 47(1), 47(4), 47(7), 53(5), 60(8), 121, 147(2)(e), 246(5)(c), and 259

<sup>334</sup> LOSC Article 121(1)

<sup>335</sup> DW Bowett "Islands, Rocks, Reefs, and Low-Tide Elevations in Maritime Boundary Delimitations" in Charney n235 p132

- e) islands that can sustain human habitation or have an economic life of its own;
- f) islands that cannot sustain human habitation or have an economic life of its own;
- g) islands which would normally be low tide elevations but now have a structure, such as a lighthouse built on it;

These islands can be grouped into two types;

- a) those that are used purely as an extension of the claims of a coastal State and
- b) those that enjoy entitlement in accordance with LOSC.<sup>336</sup>

The effect of these islands on delimitation will be considered in Chapter VI when dealing with Delimitation.

The geographical implications of islands is that the relevant information about its structure and position must be determined by a coastal State to be able to serve that States best interests when delimitation is being considered.

There are delimitations where geographical features have not been considered at all. This is obviously the case in the Treaty between the Cook Islands and the US<sup>337</sup> where the boundary line was drawn between small islands, and in the Treaty between Gambia and Senegal (1975)<sup>338</sup> and Columbia and Ecuador (1975).<sup>339</sup>

Maritime geographical factors are also more subject to change than land factors. The coast and the seabed are dynamic areas subject to greater change factors than on land. The major geographical aspects that could influence the Articles of LOSC relate to the identification of features and to a certain extent resources. This identification is integrated with geological and survey considerations and in addition land based pollution, research, exploration, exploitation and the demarcation of boundaries have geographical considerations.

In LOSC<sup>340</sup> islands are further defined. The maritime zones that may be claimed by the various types of islands are also defined. Article 121(2) provides for an island to generate all zones including a continental shelf. Regardless of the intentions of the drafters of the final Convention document these provisions have only served to confuse the situation. It is inconsistent in marine-geological definitions for an island to have a continental shelf and it has become apparent that the criteria governing island continental shelf claims should have been more clearly stated.

Arguments have been advanced that the term 'natural prolongation' contained in LOSC, when applied to islands, precludes the extension of the continental shelf onto oceanic crust. If an island is on an oceanic crust to start with it's only 'natural prolongation' must continue on that crust. The US argues that these islands should be confined to a maximum continental shelf of 200 nm. This would be the continental shelf beneath the exclusive economic zone that they would be entitled to generate. It is interesting to consider the situation of New Zealand, Japan and Indonesian States. They are situated on either mid-oceanic ridges or oceanic crust and the US has not objected to the continental shelf programmes of these States.

<sup>336</sup> *ibid*

<sup>337</sup> Cook Islands/ United States (American Samoa) *TIAS* No. 10774 (1980)

<sup>338</sup> Gambia/Senegal n248

<sup>339</sup> Colombia/Ecuador n248

<sup>340</sup> LOSC Articles 121(2) and(3)

*The continental margin comprises the submerged prolongation of the landmass of the coastal State, and consists of the seabed and subsoil of the shelf, the slope and the rise. It does not include the deep ocean floor with its oceanic ridges or the subsoil thereof.*<sup>341</sup>

If the requirements of LOSC are applied strictly according to the US interpretation then these States are not entitled to claim that the natural prolongation of their landmass entitles them to a continental shelf.

The Continent Ocean Boundary (COB), which is the boundary between oceanic and continental crusts, does not necessarily coincide with the edge of a continental margin and there is no guarantee that islands situated on a margin will be on continental crust. If these islands are able to extend the continental shelf claim of a mainland State then it can be argued that other islands situated on oceanic crust should be able to do the same.

LOSC provides that

*rocks which cannot sustain human habitation or economic life of their own shall have no exclusive economic zone or continental shelf.*<sup>342</sup>

The term 'to sustain human habitation' is again not defined in LOSC. This could be interpreted as meaning that a rock on which one person is able to exist without outside assistance could be considered an island generating all maritime zones. A rock that is above high tide is an island in terms of LOSC.<sup>343</sup> If a structure was built on this rock it could be adequate for a person to sustain 'human habitation' but by exploiting the 12 nm territorial zone to which the rock is entitled. This person could lead a comfortable if lonely life. Being able to sustain human habitation this island may now claim an exclusive economic zone and a continental shelf.

While the presence of close offshore islands on one side of a proposed lateral boundary will seriously influence a lateral delimitation when the situation is considered without the presence of the islands, LOSC does make provision for these islands to generate baselines and only an agreement between the States concerned can alter that.<sup>344</sup>

The disproportionate influence that an island can exert when such a delimitation of a boundary between States is determined will require an agreement between the States concerned or a ruling by a tribunal. In the Anglo/French Arbitration the Scilly Isles were given 1/2 effect. This meant that a median line was determined as if the islands did not exist and another determination was made where the islands were accorded full effect. By agreement a line was adopted half way between these two options. This is called giving 1/2 effect.<sup>345</sup>

The Netherlands has incorporated its islands Walcheren, Schouwen, Texel and Vleiland into its baselines without international objections being made.<sup>346</sup> Prior to the handing over of the Penguin Islands to Namibia by South Africa a situation existed where twelve islands, some within the natural harbour of Luderitz, were able to generate maritime zones. The islands has been used for the collection of bird droppings (guano) by the Cape and later the South African Governments for more than 100 years. The political complications of ownership overshadowed any technical considerations for, while it was clear that a 1867 Letter of Protocol between the Cape Colonial Government and the German Government gave sovereignty of the islands to South Africa, this agreement was

<sup>341</sup> LOSC Article 76(3)

<sup>342</sup> LOSC Article 121 (3)

<sup>343</sup> LOSC Article 121(1), AJ Hoffman Die Regime van Eilande in die Internasionale Reg met Spesiale Verwysing na die Suid-Afrikaanse Eilande aan die Kus van Suidwes-Afrika/Namibia (1987) p185-189

<sup>344</sup> LOSC Articles 5, 6

<sup>345</sup> Anglo/French Arbitration n 167

<sup>346</sup> Norwegian Royal Decree (1967) 595 UNTS 105 (1967)

contested when Namibia attained independence and the islands and Walvis Bay have now been handed over to Namibia.

Geographic and geological factors would have led to interesting negotiations had a delimitation been necessary.<sup>347</sup>

## **LAND TERRITORY**<sup>348</sup>

*A general term in the Convention that refers to both insular and continental land masses that are above water at high tide.*<sup>349</sup>

### **Comment**

Land territory could include part of a continent, an island, (including rocks permanently above high water) and reefs permanently above high water.

## **LOW-TIDE ELEVATION**<sup>350</sup>

*A low tide elevation is a naturally formed area of land which is surrounded by and above water at low tide but submerged at high tide.*<sup>351</sup>

### **Comment**

A low tide elevation is a term used in LOSC for geographical features that are exposed at some stage of the tide such as drying banks or rocks. The geographical position of a low tide elevation is very significant to a coastal State. If it is within the breadth of the territorial sea of the coastal State or one of its islands the low water line of the low tide elevation may be used to extend the zones that are so generated. If a further low tide elevation then falls within the now extended territorial sea the procedure may not be repeated.

This is a geographical consideration that featured in a small way in the Anglo/Norwegian Fisheries Case.<sup>352</sup> In 1949 the United Kingdom challenged the Norwegian proclamation of series of straight baselines from which the Norwegians claimed an exclusive fishing zone of 4 nm. The Norwegians proclaimed these baselines by Royal Decree in 1935 and amended them slightly in 1937.<sup>353</sup> The UK did not contest the distance of 4 nm claimed although it was greater than the normal breadth of the territorial sea of 3 nm at that time. They did object, however, to the fact that the fishing zone was calculated from baselines that were not on the mainland and did not follow the direction of the coast. They contested the practice of drawing the baselines to low tide elevations.

The argument put forward by Norway was that the territory of a State was that territory that was visible at any stage of the tide. The findings of the Court in favour of Norway would appear to be as a result of the UK admitting to basepoints on drying rocks and low tide elevations provided they were inside 4 nm from the coast. As all Norway's basepoints were within 4 nm the ruling of the Court was not openly contentious. This could have had bearing on the deliberations of the third United Conference on the Law of the Sea, which resulted in LOSC.

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<sup>347</sup> Hoffman n341 p187

<sup>348</sup> LOSC Articles: 2(1), 76(1), 121(2), 298(1)(a)(i)

<sup>349</sup> LOSC Articles 2(1) and 76(1)

<sup>350</sup> LOSC Articles: 7(4), 13, 47(4)

<sup>351</sup> LOSC Article 13(1)

<sup>352</sup> Anglo/Norwegian Fisheries Case n46

<sup>353</sup> Royal Decree (1935) Amended (1937) Netherlands International Law Review 1 (1954)p 256-7

## **LOW WATER LINE/MARK (LWL)**<sup>354</sup>

*The intersection of the plane of low water with the shore. The line along the coast, or beach, to which the sea recedes at low water.*

### **Comment**

Various definitions of the low water lines have been adopted by coastal States and in some instances, like the US, one low water line has been adopted for the Atlantic coast of America and the Gulf of Mexico and a different one for the Pacific coast and Alaska.

To be able to establish the outer limits of the various zones and the position of lateral boundaries, the positions of the normal and straight baselines must be correctly determined. As the terminal of the straight baselines should be on the normal baseline, the low water line, this line must be accurately identified and surveyed. This applies to the continent, islands and low tide elevations.

The various low waters are;<sup>355</sup>

### **Lower Low Water (LLW)**

*The lower of two low waters occurring during a tidal day if the diurnal inequality is appreciable;*

### **Lowest Astronomical Tide (LAT)**

*The lowest tide level that can be predicted to occur under average meteorological conditions and under any combination of astronomical conditions;*

### **Lowest Low Water**

*An arbitrary level conforming to the lowest tide observed at a place, or somewhat lower;*

### **Low Water (LW)**

*The lowest level reached at a place by the water surface in one oscillation. Also called 'low tide'.*

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<sup>354</sup> LOSC Articles: 5, 6, 7(2), 9, 10(3)(4)& (5), 13(1)

<sup>355</sup> International Hydrographic Organisation Hydrographic Dictionary SP32 Part 1 Vol S(5<sup>th</sup> Ed) (1994) p135

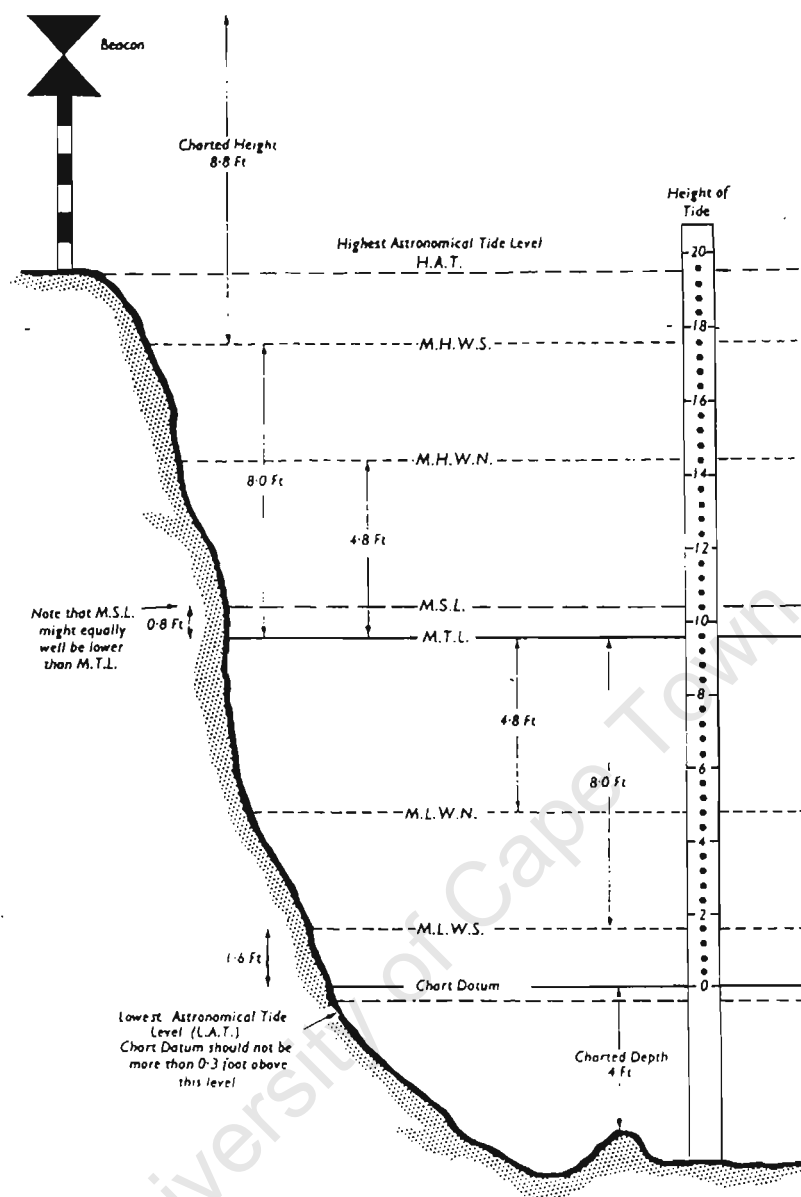


Figure 13 THE RELATIONSHIP BETWEEN THE VARIOUS TIDES AND CHART DATUM

## SEA-LEVEL

Geological history records clearly the fact that climate and sea-level have been subjected to changes, in instances marked changes, occurring over many millennia. These changes in sea level are known as 'eustatic changes'. While there is no conclusive evidence that the presence of chlorofluorocarbons (CFC) and other 'greenhouse gases' released into the atmosphere have been responsible for global warming they have contributed and researchers have recorded a small but consistent rise in the average global temperature this century.<sup>356</sup> A number of factors have to be considered to account for the rise in sea levels that have occurred this century. They include changes in water temperature and volumes, upward or downward movement of the continent and changes in ocean basins. The factors regarded as having the greatest effect are water volumes and ocean basin

<sup>356</sup> P Hughes, GB Brundrit, & FA Shillington. "South African Sea-Level Measurements in the Global Context of Sea-Level Rise", *South African Journal of Science* Vol 87 (September 1991) p447



activity. The rise in sea level on the West Coast of southern Africa is considered to be an approximate increase of 12 mm per decade. This translates into about 120 mm per century.<sup>357</sup>

Initial predictions of 3.5 metres by the year 2100 have been revised to more realistic figures but a rise of about 20 cm by 2030 is realistically expected.<sup>358</sup> Some researchers believe that there is evidence that 18 000 years ago the sea level was about 120-130 metres below present day levels.<sup>359</sup> The fall in sea-level is reliably thought to be as a result of large quantities of water being utilised in the formation of the huge glaciers and ice fields that covered large portions of the earth during the Pleistocene epoch. The result of this fall in sea level was that erosion was accentuated and while the valleys were deepened by this erosion the sediment was deposited in ocean basins much further seawards than they are being deposited today. In addition shallow portions of the coast were exposed and terrain, which was previously submerged and not subject to the action of waves were now seriously affected by inshore activities.<sup>360</sup>

The level of the sea has varied considerably throughout geological history resulting in various rates and areas of disposition. The determination of marine geological structures could be facilitated by the examination of the history of the area and the sea level during the various stages of geological history. These would be important factors for consideration in determining the geomorphology of the continental margin. Changes in sea level in various areas are related and an indication of sea-level trends on a wider basis is possible.<sup>361</sup>

The impact of a sea-level rise or fall on the nearshore region will be to introduce new wave and currents effects and patterns and it will increase, or decrease, bottom pressure. The geography and geology of an area will have a large input into the consequences of increased sea level. New wave patterns could cause increased erosion as a result of increased wave height. It is difficult to anticipate what effect increased sea level would have on the currents as they tend to be related more to the general configuration of the coast. Changed climatic conditions will either result from sea level change or it could have been one of the contributing factors to the rise.

The obvious effect will be at the low-lying coastlands, estuaries, wetlands, beaches and coasts. The effect is, however, felt far more widespread. Rivers, river mouths, islands, low tide elevations, harbour installations, sediment rates, sediment layers and oceanic basins will all be affected. It is possible, and in some instances highly probable, for the normal baseline to be drastically altered. This baseline may have been used to determine lateral boundaries or outer limits of maritime zones. Low tide elevations could submerge and be below the low water line either by the rise in the water or as a result of erosion created by new wave and current patterns.

It is estimated that 70% of the worlds sandy beaches are eroding and an increased sea level would aggravate the situation and increase the erosion.<sup>362</sup> It is also possible that increased sea level could increase the transportation of terrigenous sediment and the beaches could increase rather than decline.

The increase in sea level could extend many kilometres up a river and the effect on the boundaries of States that accept the position of a river as the boundary and where the terrain is relatively flat, could be extensive. A State such as The Netherlands is an obvious case that a sea-level rise will

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<sup>357</sup> ibid p450

<sup>358</sup> ibid p451

<sup>359</sup> C Evans "The Geology of the Continental Shelves", Proceedings Seminar on the Technical Aspects of the Law of the Sea International Hydrographic Bureau (November 1990) p 9, E Seibold & WH Berger The Sea Floor 2nd Ed (1993) p55

<sup>360</sup> F Press & R Siever Earth (1986) p264

<sup>361</sup> RA Warrick (ed) "Climate and Sea Level Change: A Synthesis", Climate and Sea Level Change (1993)

p74/75

<sup>362</sup> ibid p299

dramatically affect but the situation in the Bay of Bengal, the Ganges-Brahmaputra-Meghna Delta, and the Mississippi River could be even more devastating.<sup>363</sup>

The continents of the Northern Hemisphere were subjected to a greater degree of ice coverage than most other areas and when the ice retreated the subsequent loss of weight of the ice resulted in those continents rising isostatically. This means that while the sea level has risen dramatically the continents have also risen albeit minutely in comparison.<sup>364</sup>

*An example of recent eustatic change is that recorded by tide-gauges in the past 200 years and ascribed to melting of polar ice caps. An example of more local change is the 'glacial rebound' documented in Scandinavian countries and Canada associated with the unloading of the crust with the retreat of ice.*<sup>365</sup>

*The sea level rose in response to the melting of glacial ice, chiefly the Laurentine and Scandinavian Ice Sheets...*<sup>366</sup>

The result of this rise is found in the structure of the continental margins and in the sediments both in the margins and on the deep ocean floor.

While this rise may have economic implications ashore the factors causing the rise will probably have a greater effect seawards. Changes in the water temperature could alter the weather patterns, the types of micro-organisms the sea plant life and the types and quantities of fish.<sup>367</sup> This is not a direct consideration of LOSC but where the normal baseline changes dramatically as a result of the rise the impact on the zones and in particular internal waters is considerable.

In cases, such as the town of Walvis Bay, which has an average relief of 1.5-3.0 metres above mean sea level, the impact of any sea-level rise, could have relatively serious consequences, although the rise may be gradual. Erosion and sediment patterns will alter with the change in sea level and in the case of Walvis Bay where the supply of fresh water is dependent on a small coastal aquifer, the rise will cause the intrusion of salt water.<sup>368</sup>

A major factor that could have LOSC implications for Walvis Bay is the effect that a rise or fall in sea level would have on Pelican Point. This point is dynamic and as a result of heavy deposition on the seaward side it has been growing in a northerly direction at a considerable rate.

*It is estimated that Pelican Point has developed northwards at a rate of 17m/yr over the last 200 years*<sup>369</sup>

It is possible that a change in sea level could result in a change of current patterns, which in turn could alter the deposition rates or result in erosion. If major changes take place at the natural entrance points of bays it is possible that the border between internal and territorial waters could be seriously altered.

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<sup>363</sup> ibid p301

<sup>364</sup> Press n358 p264

<sup>365</sup> MJ Keen An Introduction to Marine Geology (1968) p91

<sup>366</sup> Seibold n357 p135

<sup>367</sup> P Hughes & G Brundrit "An Index to Assess South Africa's Vulnerability to Sea-Level Rise" South African Journal of Science Vol 88 ( June 1992) p308

<sup>368</sup> P Hughes, GB Brundrit & S Searson "The Vulnerability of Walvis Bay to Rising Sea Levels" Journal of Coastal Research Vol 8, No 4 (1992) p873

<sup>369</sup> ibid p872

## NATURAL ENTRY POINTS <sup>370</sup>

*Natural entry points have not been defined in LOSC or The TALOS manual. They are however essential for the drawing of closing lines across bays and river mouths.*

### Comment

Natural entry points must be identified on the low water line on headlands or on the banks of the mouths of rivers where closing lines are to be drawn. This is a geographical requirement which is not specifically referred to in the Articles dealing with river mouths.

The Special Masters recommendation to the Supreme Court in the United States v California Case <sup>371</sup> was as follows;

*Where pronounced headlands exist at tributary waterways, the appropriate landmark is the point of intersection of the plane of ordinary low water with the outermost extension of the natural headland. Where there is no pronounced headland, the landmark is the point of intersection of the ordinary low water mark with a line bisecting the angle between the general trend line of the ordinary low water mark along the open coast and the general trend line of the ordinary low water mark along the shore of the tributary waterway.* <sup>372</sup>

The term 'natural' should be treated with circumspection as the change in the direction of coastlines varies to such an extent that the points marking the outer limits of a bay could either be readily agreed upon, due to marked changes in the direction of the coast or with difficulty as a result of the lack of a precise geographical configuration. Further;

*....one should look for the point where the two dimensional character of the bay is replaced by that of the sea or ocean. At what point does the general direction of the shore change from one facing on the bay to one facing on the sea.* <sup>373</sup>

A 45 degree angle test that has been applied in Court decisions affecting baselines of individual US coastal States. <sup>374</sup>

This method was not used in Post Office v. Estuary Radio. <sup>375</sup> The Court of Appeal held that a closing-line could be drawn and the area accepted as a bay. The Court gave greater credence to the evidence given by experts who had had experience in delimitation than to that given by scientists who had not.

## OFFSHORE (See Page 329)

### PORT <sup>376</sup>

*A place provided with various installations, terminals and facilities for loading and discharging cargo or passengers.*

<sup>370</sup> LOSC Articles 9,10(3)(4)(5)

<sup>371</sup> US v. California (1947) 332 US 19 84

<sup>372</sup> A L Shalowitz Shore and Sea Boundaries Vol 2 (1964) p372

<sup>373</sup> L M Alexandra A Comparative Study of Offshore Claims in North-eastern Europe (1960) p209-215

<sup>374</sup> *ibid*

<sup>375</sup> Post Office v. Estuary Radio n277 p740

<sup>376</sup> LOSC Articles: 11, 18(1), 92(1), 98(1)(c), 211(3), 219, 220(1) (3) 225 and 255

### **Comment**

LOSC has drawn a distinction between 'harbours' and 'ports' by referring to both but as a large harbour can be considered a port the Articles referring to either of these should be read in conjunction with Articles pertaining to the other.

### **REEF**<sup>377</sup>

*A mass of rock or coral which either reaches close to the sea surface or is exposed at low tide.*

### **Comment**

As a reef could have other characteristics such as drying or fringing further definitions are necessary.

### **Drying Reef.**

*That part of a reef which is above water at low tide but submerged at high tide.*

### **Fringing Reef**

*A reef attached directly to the shore or continental land mass, or located in their immediate vicinity.*

The significance of the fringing reef is that if this reef is located on an atoll then the seaward low water line is taken as the baseline of the island

### **RIVER**<sup>378</sup>

*A relatively large natural stream of water.*

### **Mouth (River)**

*The place of discharge of a river into the ocean.*

### **Comment**

If the river flows directly into the sea, then the straight line drawn across the river mouth from the low water line on the seaward-most portions of its banks will form the baseline.

A problem could exist where it is difficult to distinguish between a bay and a river entering the sea via an estuary. The estuary could expand gradually into a very wide indentation and unless the restrictions applicable to the closing of bays is applied to estuaries some of the closing lines of estuaries could be extensive. LOSC does not contain criteria for estuaries nor does it classify estuaries as bays. Where more than one State is situated in a bay the bay may not be closed. In the case of an estuary however there is no such restriction. Argentina and Uruguay have drawn a straight line across the mouth of the River Plate which has been considered earlier in this Chapter.

### **ROADSTEAD**

*An area near the shore where vessels are intended to anchor in a position of safety; often situated in a shallow indentation of the coast.*

*Roadsteads which are normally used for loading, unloading and anchoring of ships, and which would otherwise be situated wholly or partly outside the outer limit of the territorial sea, are included in the territorial sea.*<sup>379</sup>

<sup>377</sup> LOSC Articles: 6, 47(1) (7)

<sup>378</sup> LOSC Articles: 9, 66(1) (20) and (3)(c)

### Comment

Roadsteads fall normally under the control of a Port Authority who will direct vessels to safe anchorage outside the port while the vessels are awaiting permission to enter. The positions of roadsteads are therefore not always specifically indicated on the charts of that coastal State. Should they wish to take advantage of Article 12 however then the outer limits of the roadstead will have to be co-ordinated- and given due publicity.

### ROCK

*Consolidated lithology of limited extent.*

### Comment

There are two uses of the term 'rock' in LOSC;

- a) where a rock can be classified as an island;
- b) where the thickness of sedimentary rock in relation to the distance from the position where the sediment thickness was measured to the foot of the continental shelf can be used as a criteria for determining the outer limits of the continental shelf claim of the State.<sup>380</sup>

### STRAIT

Geographically a narrow passage between two landmasses or islands or groups of islands connecting two larger sea areas.

### Comment

LOSC has numerous Articles dealing with straits, their legal status, pollution, transit passage, innocent passage, over flight, sea-lanes, safety aids, traffic separation and international navigation. These aspects will be dealt with in subsequent chapters.

### SUPERJACENT WATERS

*The waters overlying the seabed or deep ocean floor.*

### Comment

LOSC refers only to the superjacent waters over the continental shelf and those superjacent to the Area.

### THALWEG

*The line of maximum depth along a river channel. It may also refer to the line of maximum depth along a river valley or in a lake.*

### Comment

This is an old European term used when States border or use navigable rivers for passage and transportation. For rivers to be considered as international waterways more than one State must border the river and the river may then be regarded as inland (internal) waters. These internal waters are not covered by LOSC unless they are tidal. In the event of the river being tidal the thalweg, which could be anywhere on the bed of the river, becomes a delimitation factor.

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<sup>379</sup> LOSC Article 12

<sup>380</sup> LOSC Article 76(4)(a)(i)

It would serve little purpose to adopt the middle of the river as the boundary between States when the deepest channel, which will be in constant use, is close to one of the banks and wholly in the territory of one of the States. Thalwegs are not referred to in LOSC.

## **TIDE**

*The periodic rise and fall of the surface of the oceans and other large bodies of water due principally to the gravitational attraction of the Moon and Sun on a rotating earth.*

### **Comment.**

While tides are not referred to in LOSC tidal effect is critical to many of factors used in delimitation and other related matters. Baselines, closing lines, low-tide elevations, equidistant calculations and natural entry points are totally dependent on reliable data of tidal activity in the region.

## **Chart Datum**

*The tidal level to which depths on a nautical chart are referred to constitutes a vertical datum being called Chart Datum.*

### **Comment.**

Chart datum are chosen as close to the lowest depth to which a tide will fall. This is to ensure that the depths reflected on nautical charts is the minimum depth of water that a navigator can expect for his vessel in that position. This datum is chosen to ensure that all tidal heights are above it and most countries have adopted lowest astronomical tide as chart datum.<sup>381</sup>

## **WATER COLUMN<sup>382</sup>**

*A vertical continuum of water from the sea surface to the seabed.*

### **Comment**

This term is used in relation to marine research beyond the exclusive economic zone and indirectly with reference to superjacent waters in the area from the baselines to the outer limits of the same zone.

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<sup>381</sup> IHO Dictionary n353 p126

<sup>382</sup> LOSC Article 257

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## CHAPTER VI

## GEOLOGY

## INTRODUCTION

The earth has evolved to its present form over thousands of millions of years. This history is reflected in the geological structures evident to us. In the same way that the determination of the shape of the earth occupied the attention of the early scientific community, the geological composition of the earth did likewise. As the extent of the LOSC continental shelf claim of a coastal State may be determined by the geological composition and configuration of the continental margin, it is necessary to consider marine-geological data and the methods necessary to determine such data.<sup>383</sup>

The consideration of geological factors included in LOSC is complicated by the fact that some marine-geo- logical terms have been given legal definitions in conflict with those normally accepted by marine geologists. In particular, the definitions given, in LOSC, to islands and continental shelves require very careful consideration.

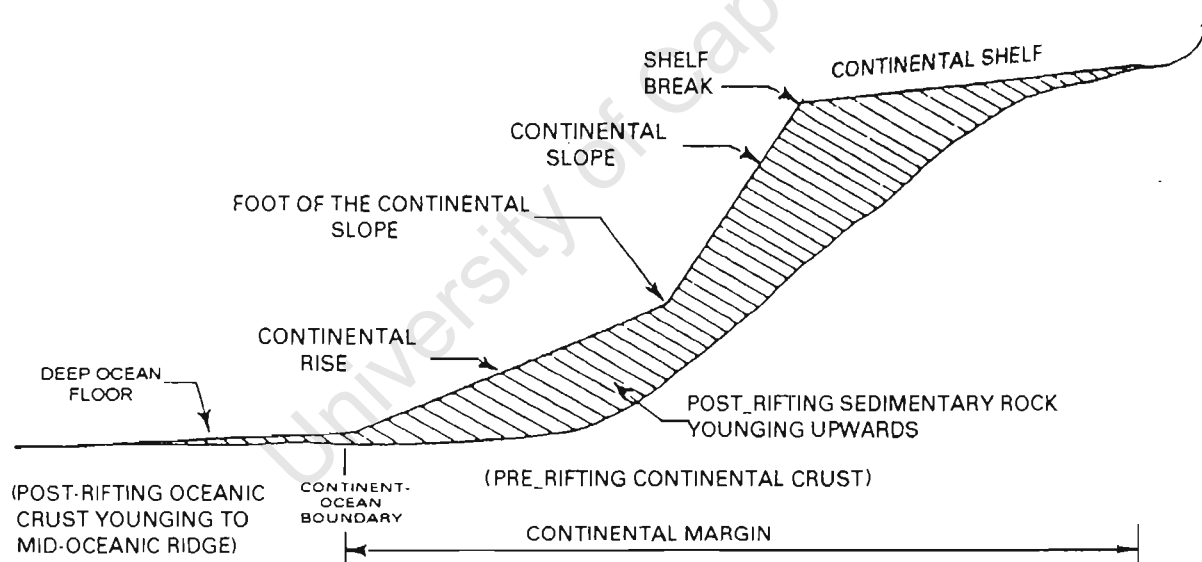


Figure 14 THE MARINE-GEOLOGICAL CONTINENTAL SHELF AND DEEP OCEAN FLOOR

The portion of the seabed from the low-water line to the outer limit of the continental rise is the continental margin. At this position the deep seabed commences. The line dividing resources, between those belonging exclusively to the coastal State and those regarded as being for the benefit of all, is usually found in the region of the COB. Due to the fact that the relevant Articles of LOSC rely on mathematical methods, the outer limits of the LOSC continental shelf bear little relation to the marine-geo- logical continental shelf.<sup>384</sup>

<sup>383</sup> LOSC Article 76

<sup>384</sup> Guy n281 p5



The continental margin comprises three major provinces, the continental shelf, the continental slope and the continental rise. The zone where the lesser inclination of the continental shelf increases dramatically seawards to become the continental slope is known as the shelf break. The outer limit of the continental margin is regarded as being one of the major geological boundaries and approximates the boundary of continental and oceanic crusts.<sup>385</sup>

The earth consists of the lithosphere (crust and upper mantle), the lower mantle and the central core. Continental crust is made up of mainly older, less dense material than the mainly newer, denser, oceanic crust. Oceanic crust is created by the extrusion of material from the asthenosphere, near the top of the mantle, during ocean-floor spreading.<sup>386</sup>

The shelf break usually occurs in depths between 100 and 200 metres. The continental slope lies seaward of the shelf break and its gradient is often about 4 degrees. Slope sediments are a mixture of marine biogenic sediment, (rich in planktonic foraminifera and other microfossils) and terrigenous sediment (quartz and clay minerals derived from the land). At the foot of the continental slope is the deep ocean floor on oceanic crust, but in most margins deposition seaward of the foot of the slope results in sediments that form the continental rise. In active margins this is usually very short or non-existent, because of the subduction of the oceanic crust under the continental crust.

The continental rise that forms at the foot of the slope also consists of a mixture of biogenic and terrigenous (hemipelagic) sediment. The geological configuration at the junction of the Continent Ocean Boundary has a marked effect on the extent of the claims that can be made in terms of LOSC.

The extent of claims to LOSC continental shelf will depend on the nature of the underlying crust, the configuration of the marine-geological continental shelf and continental slope and, in particular, the foot of the slope and the sediment thickness under the continental rise.

## GEOLOGICAL THEORIES

A relationship between continents was first propounded as continental drift by Wegener in 1915<sup>387</sup> and was later supported by the South African geologist, DuToit,<sup>388</sup> Hess,<sup>389</sup> and Vine and Matthews.<sup>390</sup> Morgan developed this as the theory of plate tectonics<sup>391</sup> and the concept is that the earth's entire surface comprises a series of rigid plates with thickness of between 100 - 150 km.<sup>392</sup>

There are seven major plates or crusts of varying sizes. The Pacific Plate is extremely large, whereas the Anatolian Plate on which Turkey is situated, is far smaller.<sup>393</sup> South Africa is on the African Plate with boundaries along the mid-oceanic ridges and collision zones with the European and Aegean Plates.

The earth's crust and the upper mantle are collectively known as the lithosphere (plate) and the underlying zones are known as the lower mantle and the core. The asthenosphere is that part of the lower mantle immediately underlying the base of the lithosphere.<sup>394</sup>

<sup>385</sup> JP Kennett *Marine Geology* (1982) p28-29

<sup>386</sup> D L Eicher and A L Mc Alister *History of the Earth* (1980) p181

<sup>387</sup> AJ Wegener *The Origin of the Continents and the Oceans* (in translation) (1966) p5

<sup>388</sup> AL du Toit *Our Wandering Continents* (1937)

<sup>389</sup> HH Hess "History of Ocean Basins" *Petrologic Studies A Volume in Honour of AF Buddington* (1962) p599-620

<sup>390</sup> FJ Vine & DH Matthews "Magnetic Anomalies over Oceanic Ridges" *Nature* (1963) p947-949

<sup>391</sup> WJ Morgan "Rises, Trenches, Great Faults and Crustal Blocks" *J Geophys Res* 73 (1968) p1959

<sup>392</sup> *ibid* p208

<sup>393</sup> Eicher n384 p183

<sup>394</sup> Seibold n357 p374

Eicher and McAlister state

*Continents are merely thick sialic masses embedded in the lithospheric plate.* <sup>395</sup>

Oceanic crust consists mainly of basalts, whereas continental crust has a more complex composition of a wide variety of rocks. As a result of the fact that the continental crust is less dense than the basaltic oceanic crust, the theory of isostasy developed. <sup>396</sup> The theory holds that the crust 'floats' on the upper mantle, both the thicker less dense crust and the thinner, heavier, denser oceanic crust. <sup>397</sup> The continents are regarded as being an accumulation of mantle-derived material up to thousands of millions of years old and less dense than the much younger denser oceanic crust, which is no older than 200 million years.

As a result of ocean-floor spreading and the extrusion of asthenospheric material from beneath, shallow earthquake activity is prevalent along the mid-oceanic ridge, where ocean-floor spreading occurs. All the oceanic crust, older than 200 million years, has now been subducted (forced downwards as a result of convergence of plates) and consumed in the lower mantle. It is also believed that ocean basins periodically open and close in what is called the Wilson Cycle. <sup>398</sup>

Although LOSC does not refer to tectonic plates or different types of crusts, some States have used the presence of certain types of crust to justify extended LOSC continental shelf claims. The UK endeavoured to extend its LOSC continental shelf claim over the Rockall Trough to the Rockall Plateau, based on the fact that both are situated on a marine-geological continental shelf. <sup>399</sup>

## DEVELOPMENT WITHIN A MARGIN

Coastlines are dynamic and the factors responsible for erosion, transportation and deposition include tides and tidal currents, wave action, ocean currents, storm action and surges, terrigenous sediment supply and land subsidence. The geology of the coast is not usually a criterion for consideration when the extent of a State's territory is demarcated, as the coastline and other physical features are usually regarded as being geographical. The margin parameters are, however, generally related to the movements of the continents and the activity along fault lines and oceanic ridges is geological.

The history of the geological activity of the margin and beyond affords the opportunity of establishing the subsurface structure of a margin, which will give a basis for further investigation into the other activities that occur in the region and affect LOSC considerations.

Marine-geological exploration within maritime zones is essential for delimitation procedures. The information is needed for a State to determine where subsurface (beneath the sea surface) and subsoil (beneath the surface of the seabed) features are that may increase that State's claim to a zone. This information may be necessary, as evidence, when submitting an LOSC continental shelf claim, beyond 200 nm to the UN Commission on the Limits of the Continental Shelf, as required in LOSC. <sup>400</sup>

## PLATE BOUNDARIES

The main types of margins are divergent (constructive), convergent (destructive) and translationary.

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<sup>395</sup> Eicher n384 p183

<sup>396</sup> *ibid*

<sup>397</sup> Press n358 p499-501

<sup>398</sup> *ibid* p515

<sup>399</sup> K O Emery & E Uchupi *The Geology of the Atlantic* (with maps) (1984) p294

<sup>400</sup> LOSC A2/4

### Divergent (constructive) Plate Boundaries

These plate boundaries occur where plates are moving directly away from one another. A major cause of this type of margin is the formation of mid-oceanic ridges, which are developed perpendicular to the direction of divergence and parallel to the continental margins flanking the mid-oceanic ridges. Divergent plate boundaries are formed by the rifting apart of the continental crust and the intrusion of basaltic oceanic crust to form a new oceanic basin.<sup>401</sup>

#### a) Rifting

This is the splitting of the continental crust prior to drifting.<sup>402</sup>

#### b) Drifting

This is the actual drifting of the plates with continental accretion of new oceanic crust at the mid-oceanic ridge. In the area of the continental slope, local subsidence occurs due to the initially high rate of sedimentation that builds a passive continental margin and because denser oceanic crust has a lower elevation than the less dense continental crust when 'floating' in the upper mantle of the lithosphere.<sup>403</sup>

The continental rise in passive (inactive) margins normally has gradients of the order of 1:100 to 1:700 at depths of between 3000 and 5000 metres.<sup>404</sup> The southern African continental margin on the western side is regarded as a stable, passive margin.

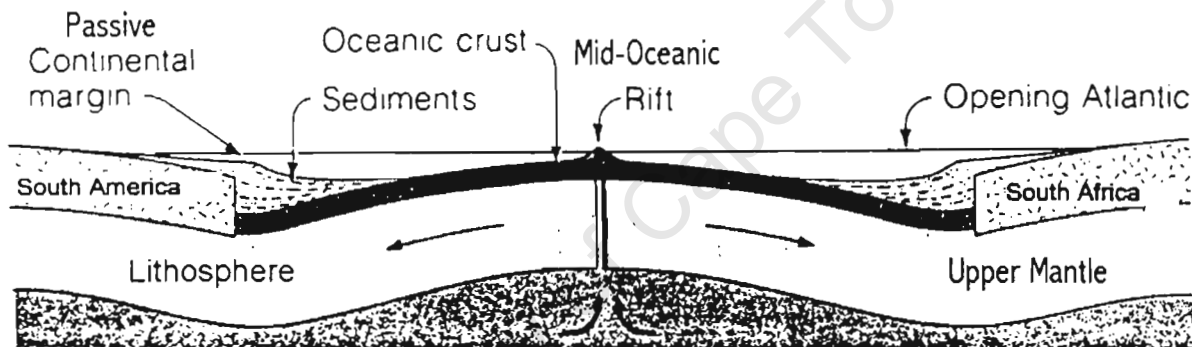


FIGURE 15 DIVERGENT PLATE BOUNDARY AND CONTINENTAL MARGIN  
(Showing erosional debris (sediments) deposited as the continents diverge)

### Convergent Plate Boundaries (Active and Destructive Continental Margins)<sup>405</sup>

On an active continental margin, plates converge and collide with one another, and denser oceanic crust will underthrust less dense continental crust where they converge. Whether the crust is oceanic or continental, one crust will always underthrust the other, to form, for example, the Peru-Chile boundary. There are three types of convergent or collisional plate boundaries;

- a) continental crust converging with continental crust as in the case of the Himalayas;
- b) oceanic crust converging with continental crust as in the case of the Peru-Chile Trench and the Andes;

<sup>401</sup> Seibold n357 p45, Kennett n383 p320-323, Press n358 p18-19

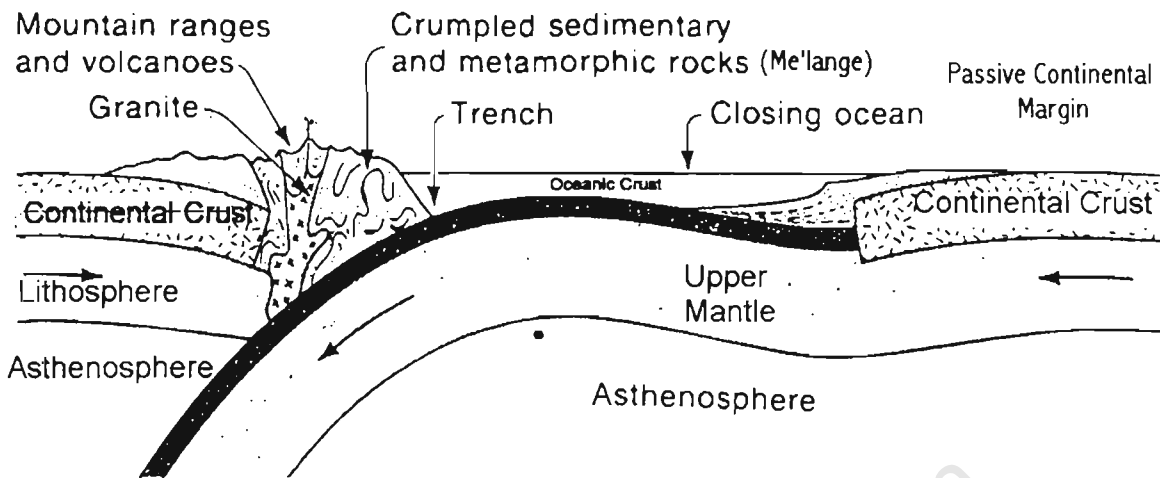
<sup>402</sup> ibid p19, Seibold n357 p 45-46, Kennett n383 p329-331

<sup>403</sup> J.G. Dennis Structural Geology (1972) p481

<sup>404</sup> ibid p436

<sup>405</sup> Kennett n383 p323, 356-361

- c) convergence of oceanic crusts along island arcs, as in the case of the Marianas Trench and the Philippines. These convergent crusts have deeper-dipping subduction zones than is the case in type b).<sup>406</sup>



**Figure 16** **ACTIVE CONTINENTAL MARGIN**  
(Showing subducted oceanic crust and the development of a high mountain chain and deep-sea trench)

An important characteristic of these margins is the folding and shearing of the sediments, the release of volcanic and plutonic material into the zone and, as a result of the partial melting of the downthrust crust, enrichment of metals can occur. Many plate boundaries of oceanic and continental crusts coincide with the continental margins, and in this area of convergence, where one crust is subducted, that crust will be the denser oceanic one. This action causes the formation of deep-ocean trenches along the continental margin and will normally result in the margin being truncated. The rock types in these margins are varied, with material introduced as a result of subduction, and are coupled with the sediment material which has been deposited. Enormous amounts of this sediment are deposited in the trench and can be subducted into the mantle. Contrary to the views, initially held, that material from the subducted plate was scraped off and deposited along the margin it appears that, while this does occur in some cases, material from the margin has mainly been swallowed up in the subduction zone (tectonic erosion).<sup>407</sup>

Modern subduction takes place along the oceanic trench, which is usually parallel and near to the coast as in the case of Chile. If the two plates are both continental crust it is not possible for one to subduct the other. Both plates suffer deformation and the formation of mountain belts such as the Alps, and the Himalayas, occurs.<sup>408</sup>

The edge of the margin is usually the boundary between the two crusts with the oceanic crust being of denser basalt and the continental crust lighter and of less dense sialic rocks, such as granite. It is in this area that volcanic and seismic activity is prevalent.

Convergent plate boundaries result in an active continental margin. The coasts of the entire Pacific Ocean are situated along active margins and are considered to be geologically unstable.<sup>409</sup>

Japan and Chile have active margins, but they are extending their LOSC continental shelf claims seawards, by the use of submarine ridges. Where they would have been expected to limit claims to the 200 nm from baselines, their claims are considerably greater. The UK has also the argument that as the

<sup>406</sup> Seibold n357 p51

<sup>407</sup> ibid p53

<sup>408</sup> MP Billings Structural Geology 3rd Ed (1972) p66-69

<sup>409</sup> Press n358 p264

crust beneath the Rockall Trough is continental, natural prolongation extends over the 3000 metre deep trough to the Rockall Plateau on the other side and then for a considerable distance further over the plateau.<sup>410</sup>

Plates will obviously suffer some degree of destruction during convergence and could also suffer further destruction in the subduction zone beneath the trench.<sup>411</sup>

### TRANSLATIONAL PLATE BOUNDARIES/MARGINS

These plate boundaries developed as a result of a shearing of the lithosphere. The structure of the plate boundary/margin will depend on the extent of the shearing, but the sheared margin will usually be truncated with a steep slope and a minimum rise. Fractures occur in the crust as a result of the shearing. Deformation, as a result of the formation of a sheared margin, causes fracture zones adjoining the boundary of the crusts.

These fractures are formed in small-circle trajectories about the crustal rotation. The classic case of a sheared margin is the Agulhas Fracture Zone. This sheared margin is truncated as a result of this Zone and the width of the shelf in this area can be as narrow as 5 nm. While some active margins are complex and have complex histories, this margin is readily identifiable as a sheared margin.<sup>412</sup>

Fracture zones on the ocean bottom are constantly being formed as seafloor spreading continues. The ocean floor is approximately 5000 metres deep<sup>413</sup> and is scarred with these fractures. When crusts move parallel to one another, either in an opposite or the same direction, very little lithospheric material is created or destroyed.<sup>414</sup>

The Agulhas Passage is found between the extensive submarine area, the Agulhas Plateau and the Agulhas Bank.<sup>415</sup>

*Between the southern salient of the submarine Agulhas Bank and the re-entrant submarine canyon offshore of the Tugela River mouth, north of Durban the South African continental margin, adjacent to the nearly 5 km deep oceanic basins, is of the 'sheared' type, i.e., it formed during the progress of 'strike-slip' faulting, associated with the horizontal sliding of the submarine Falkland Plateau south-westward as the South American plate drifted away from Africa.*<sup>416</sup>

### TRANSFORM FAULTS.

These faults occur where oceanic crust moves in opposite directions, on opposite sides of a transform fault, between offset sections of the mid-oceanic ridge. The fracture zones lie along small circles in the earth's surface. Similarly, little addition or destruction of the crust occurs, but if the fault does not coincide exactly with its small circle of rotation a small amount of extrusion or subduction will

<sup>410</sup> C R Symmons The Rockall Dispute Deepens ICLQ Vol 35 (1986) p371

<sup>411</sup> J P Kennett n383 p325

<sup>412</sup> Emery n397 p354, KO Emery et al "Continental Margin off Western Africa: Cape St Francis (South Africa) to Walvis Ridge (South West Africa)" The American Association of Petroleum Geologists Bulletin Vol 59 No1 (January 1975) p3-5

<sup>413</sup> Emery n397 p103

<sup>414</sup> BC Heezen & CD Hollister The Face of the Deep (1971) p3-7

<sup>415</sup> CJH Hartnady, Z Ben-Avraham & J Rogers "Deep-Ocean Basins and Submarine Rises off the Continental Margin of South-Eastern Africa: New Geological Research" South African Journal of Science Vol 88 (Nov 1992) p 534-5, BE Tucholke and GB Carpenter "Sediment Distribution and Cenozoic sedimentation patterns on the Agulhas Plateau" Bulletin of the Geological Society of America Vol 88 (1977) p1337-1346, RV Dingle "Tertiary Sedimentary History of the Continental Shelf off Southern Cape Province, South Africa" Transactions of the Geological Society of South Africa (August 1971)

<sup>416</sup> Hartnady n413 p535

occur.<sup>417</sup> Plates, which neither converge nor diverge, are still able to slide past one another along a transform fault. This occurs in a sheared margin. It usually results in a short truncated shelf and margin.<sup>418</sup>

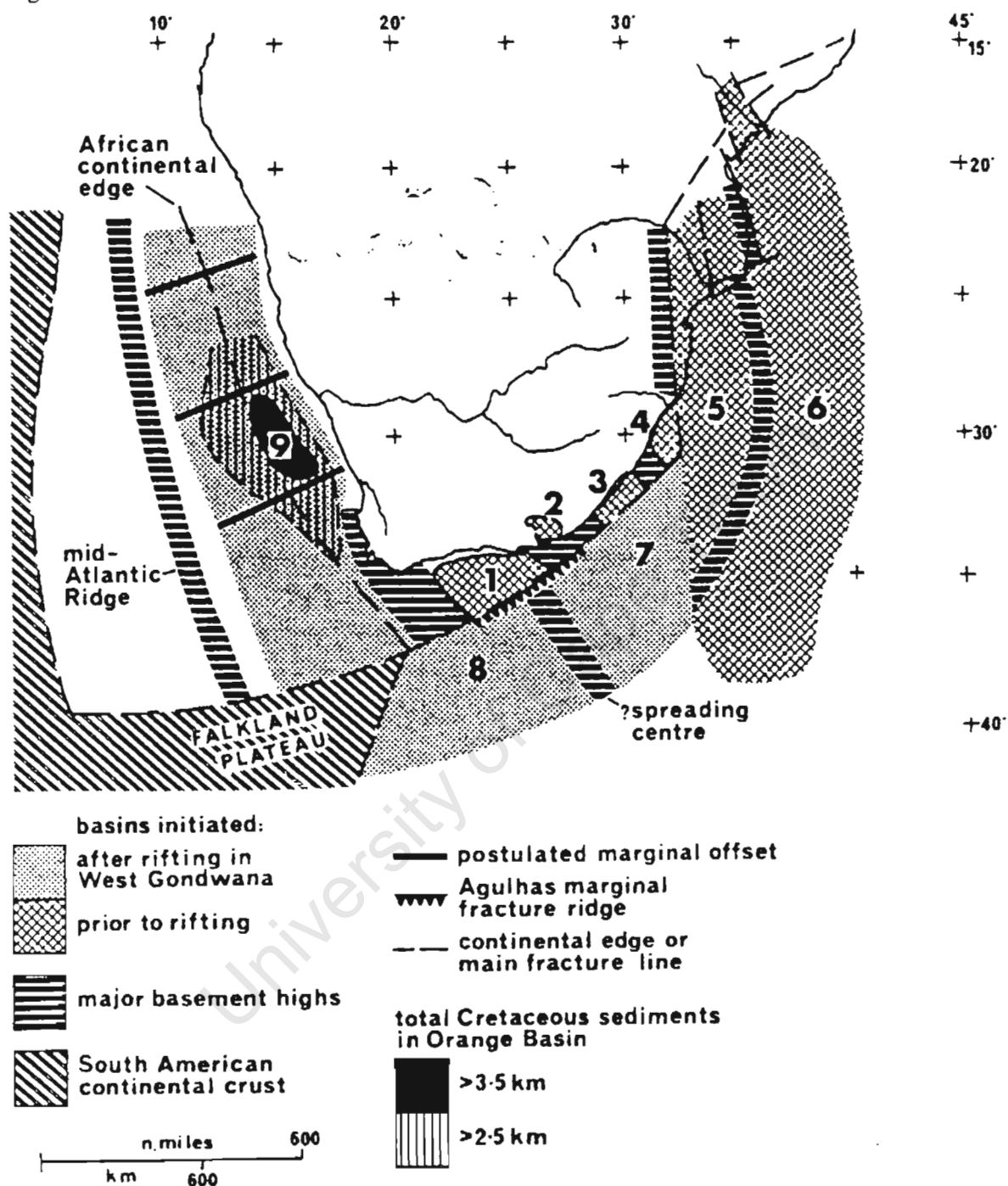


Figure 17 FRACTURE LINES EXISTING IN MID-CRETACEOUS TIMES IN THE SOUTHERN AFRICAN REGION

<sup>417</sup> Kennett n383 p133-134, Press n358 p20, 500

<sup>418</sup> ibid, Seibold n357 p 9-11, 28-29

## CONTINENTAL SHELF

The composition of the continental shelf, determined by marine-geological methods, varies considerably from continent to continent. In some instances, such as off the coasts of Europe, Africa and America, which border the Atlantic, the shelves are broad shallow platforms that are clearly an extension of the continent.<sup>419</sup> The shelves extend to the shelf break and tend to be relatively smooth, of low gradient and water over it is shallow (a few hundred metres). It normally extends from low-water line to approximately the 200 metre isobath (depth contour). The breadth of the shelf can vary considerably and is usually about 40 nm wide, unless truncated by faults. A shelf is dependent on the type of margin in which it is situated. It can extend seawards beyond 200 nm in a passive margin, whereas in an active or sheared margin, shelf width could be as little as 5 nm.<sup>420</sup>

## TOPOGRAPHY OF THE SHELF

Shelf morphology includes relief features such as banks, linear ridges, canyons, basins, depressions, channels, swales, valleys and reef channels. Nearshore areas and beaches are the most dynamic areas in the marine environment. The shelf morphology in the nearshore areas is subject to a greater influence of wind, tides, currents and in particular, wave action. Where delimitation is required in nearshore areas, the dynamics of these areas should be considered, as they could have a marked effect on the results. Changes can occur both seasonally or over longer periods of time. The geomorphology of a continental margin can be affected by river outflow and currents especially if the margins are very narrow. These could be responsible for erosion, transportation, deposition and redeposition of sediment and when the determination of zones is undertaken, care should be taken that the most recent information is considered.<sup>421</sup>

The shelf in an active margin is not necessarily smooth and is more likely to be narrow and rocky.<sup>422</sup> Due to the narrow width of the shelf, deposition may take place over the shelf break in deeper water, where the speed of transportation is reduced. In contrast to a passive margin, where a fair amount of deposition will take place on the shelf, in an active margin erosional processes play an important role.

Some continental shelves are so extensive that the waters covering them are sufficiently large to be called seas. Examples of large shelves are those under the Baltic Sea, Hudson Bay, the Persian Gulf and the North Sea.<sup>423</sup>

During the Last Ice Age (last glacial ice age), approximately 18 000 years ago, large amounts of water were trapped on the continents as ice. With the sea-water level considerably reduced, (estimated to be lowered by approximately 130 metres) large amounts of debris were deposited on the exposed continental shelves. Glaciers, moving out over the exposed shelves, also gouged deep ravines in the shelves and rivers incised valleys. These valleys were subsequently drowned as 'palaeovalleys' when sea level rose to its present level 5000 years ago.<sup>424</sup>

At the modern sea level, rivers, that are transporting significant amounts of sediment, have developed deltas at their mouths. There is a chance that sediment landslides could occur on the slope because there is insufficient time for consolidation of the sediment to have occurred. This did not, however, occur off the southern African coast.

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<sup>419</sup> RV Dingle & RA Scrutton "Continental Breakup and the Development of the Post Palaeozoic Sedimentary Basin around Southern Africa" *Geological Society of America* Vol 85 (1974) p1468

<sup>420</sup> FP Shepard *The Earth Beneath the Sea* (1960) p70, Kennett n383 p29

<sup>421</sup> Kennett n383 p307, HG Wind & EB Peerbolte "Sea Level Rise: Assessing the Problems" in Warrick n359 p298

<sup>422</sup> Seibold n357 p55

<sup>423</sup> *ibid*

<sup>424</sup> *ibid*, RV Dingle "The Geology of the Continental Shelf between Luderitz and Cape Town (Southwest Africa), with Special Reference to Tertiary Strata" *Journal of the Geological Society of London* Vol 129 p337-363 (1987), Warrick n359 p3-7

Where sedimentation takes place slowly, the sediment structure can be retained, but where the slope is steep slumping may occur which could result in a confused mass of sediment at the base of the slope.

*Bathymetric and seismic reflection surveys in the Natal Valley, east of East London, show that the most important factors in the Neogene development of the outer continental margin have been large-scale slumping and penecontemporaneous canyon formation. Slope wasting and allochthonous mass movements have shifted the foot of the continental slope up to 25 km basinward and have constructed extensive continental rise lobes.*<sup>425</sup>

*The Agulhas Slump is a large slump on the sheared margin off southeast Africa.*<sup>426</sup>

The Agulhas Slump is probably the largest slumped mass so far recognised from modern oceans (750 km long, 106 km wide with a volume of over 20 000 cubic km) and is Post-Pliocene in age. Volcanic activity, which takes place relatively close to the slope, could cause the slumping and, if the slump were sufficiently powerful, tsunamis could occur. A tsunami is defined as;

*A long-period sea wave produced by a submarine or volcanic eruption.*<sup>427</sup>

These aberrations in the seawater level can be mild occurrences, reflected only on tide gauges, or tidal waves.<sup>428</sup> The sequence is usually caused by slump, followed by a tsunami.

## SEDIMENTATION

The four major forces involved in the development of a coast are, tectonics, sedimentation, erosion, and eustatic changes in sea-level.<sup>429</sup> Besides the obvious profiles of the surface of the seafloor, the origin of the crusts and their relative positions in the margin are necessary to determine the geomorphology of the margin. The relationship of the shelf, slopes, rises, islands, ridges, reefs, rocks, plateaux, banks, caps, spurs, troughs, and sediment thickness to one another and to surrounding continents must also be obtained.

The capability of modern technology to provide this information should be considered and the reliability of the data that is at present held should be known and evaluated.<sup>430</sup>

Most of the information that can be used to depict the configuration of the seabed was obtained by hydrographic surveying methods. These surveys were conducted essentially to provide nautical charts for safe navigation with vastly different requirements from those necessary for seabed mapping. This is considered in Chapter VII. In this Chapter, also, the developments of equipment to map the seafloor will be considered and the accuracy of present and past methods will be evaluated. The structure of a continental margin is seldom simple, even when the surface appears uniform and uncomplicated. Even though it is true in the case of close to the shore on the Agulhas Bank and off the Namaqualand coast, the premise that sediment close to the coast is coarse and that it gradually becomes finer seawards and that eventually it becomes mud, is seldom the case.<sup>431</sup> The coarseness and other attributes of the sediment is unrelated to its distance from the shore.

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<sup>425</sup> RV Dingle & S Robson "Slumps, Canyons and Related Features on the Continental Margin off East London, SE Africa (SW Indian Ocean)" *Marine Geology* 67 (1985) p37

<sup>426</sup> RV Dingle "Anatomy of a Large Submarine Slump on the Sheared Margin (Southeast Africa)" *Journal of the Geological Society of London* No 134 p293

<sup>427</sup> IHO Dictionary n353 p233

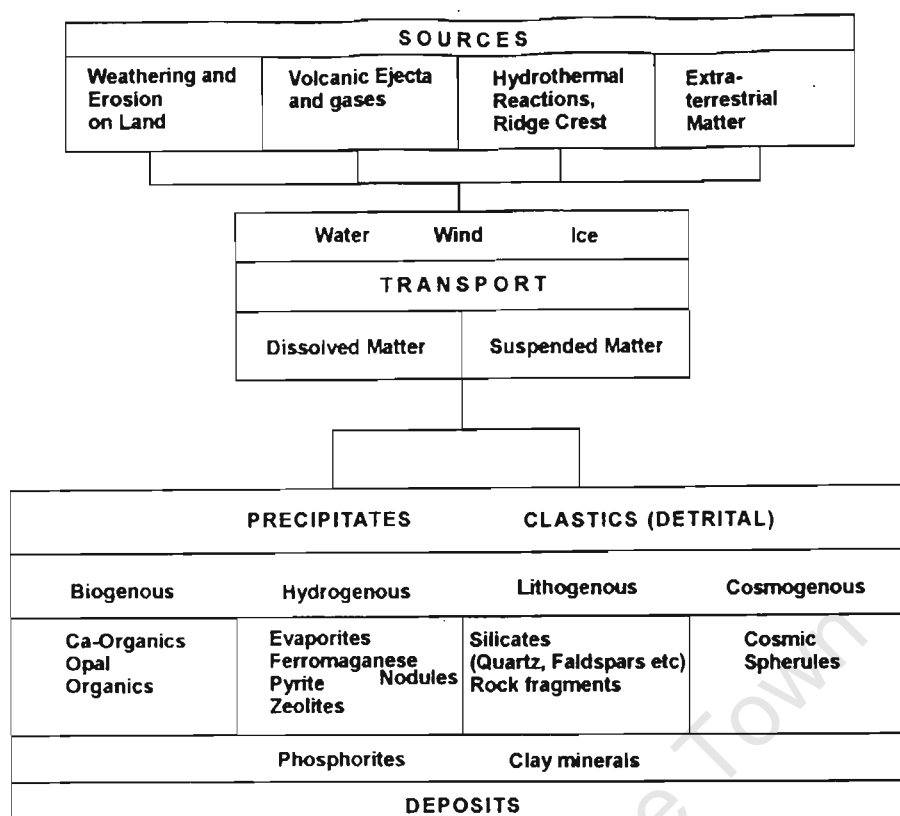
<sup>428</sup> Hill n323 p131

<sup>429</sup> VP Zenkovich *Processes of Coastal Development* (1967) p13-21

<sup>430</sup> LOSC Articles 6, 76, 121

<sup>431</sup> K O Emery "The Continental Shelf" *Ocean Science* (1977) p37





**Figure 18 SOURCES, METHODS OF TRANSPORTATION, AND TYPES OF SEDIMENTS**

The sediments on 70% of the world's continental shelves are considered to have been deposited in the last 15 000 years.<sup>432</sup> The various levels of the sea during recent geological history have also affected the rate and position of sediment deposition. It is considered that 135 000 years ago, the height of the sea was about the level that it is now. The level of the sea, during the Last Ice Age, was two thirds of the depth of the modern shelf break and that meant that during that period most of the modern continental shelf was exposed. With the extensive amount of shelf exposed and many rivers depositing their sediment directly onto it, this resulted in the finer, particles of sediment being washed over the shelf break into deeper water.<sup>433</sup> There is a great variety in the types of marine sedimentation and this affects the structure of the margin. The main source of terrigenous sedimentation is from rivers. The following diagram indicates the flow line of sedimentation from source to deposition area.

There are essentially three types of marine sediment.

#### Biogenic:

*Arrival at the site of deposition by 'in situ' precipitation (benthic organism living there) or through settling via a water column (pelagic organism coarse shells fall singly, small ones commonly arrive as aggregates)*<sup>434</sup>

Siliceous oozes are deposited on death of diatoms and radiolaria, whereas calcareous oozes are formed from the skeletons of foraminifera, coccoliths and pteropods, molluscs etc.<sup>435</sup> They are

<sup>432</sup> ibid p38

<sup>433</sup> ibid p40

<sup>434</sup> Seibold n357 p79

<sup>435</sup> Emery n397 p694, Eicher n384 p224-225

deposited as the result of settling of planktonic skeletons through the water column or on the death of benthic organisms. These sediments can be redistributed in the area by waves or currents. As the sediments are not dependent on proximity to land, their distribution is widespread over the sea-floor. It is estimated that 50% of both the deep-ocean floor and continental shelves are covered with biogenic sediments.<sup>436</sup> These sediments could contain carbonate, silica and phosphates. In addition, manganese, iron and aluminium compounds are found. Hydrocarbons come from the reconstruction of trapped organic material in the sediments. The maturation of the hydrocarbons is a post-burial phenomenon. This is considered further in Chapter X

*Sediments rich in organic matter, which have the potential to deliver petroleum when heated under pressure accumulate especially during the periods when continents are extensively flooded.*  
<sup>437</sup>

The flooding occurred over geological periods of time as a result of major rises in the level of the sea.

### Hydrogenous Sediment

This sediment precipitates from seawater or from interstitial water. Lagoons are subject to evaporation and, for geographical reasons, are only minimally augmented by seawater with lower salinity.<sup>438</sup> These sediments could contain calcium carbonate, calcium sulphate, halite and occasionally potassium salts.

### Lithogenic (terrigenous or detrital)

These sediments are transported from areas of erosion onshore to the deposition area by rivers, wind and glaciers. Physical sedimentation is the final phase of the long process that starts with weathering, mass wasting and erosion, continues via the various transportation vehicles, air and water, and travels to the lowest positions attainable. Lithogenic sedimentation starts when transportation stops. Large amounts of terrigenous deposits are deposited on the continental margin or bypass it to the deep-sea floor.

*80 per cent of all sediment is trapped in vast piles on certain continental margins.*<sup>439</sup>

Whereas biogenic sediment covers 50 % of the area of ocean and sea floor, lithogenic sediment is responsible for approximately 70% of the total volume of sediment in the sea. This is due to the high depositional rates of sediment in coastal and near-coastal areas resulting in very thick sediment deposits especially deltas, the inner shelf and submarine fans on the continental rise. These sediments could contain quartz, feldspar, mica and clay minerals such as montmorillonite, illite, chlorite, and kaolinite.<sup>440</sup> The rate and extent of sedimentation is vital to an LOSC continental shelf claim as it will affect the extent of the marine-geological continental shelf, the shape of the continental slope, the position of the foot of the slope and the extent and thickness of the continental rise. Sedimentation is an integral part of the development of the margin. Climate and ocean-basin physiography determine the nature, style and extent of sedimentation. In a southern African context Dingle *et al.* state:

*Climate dictates the quantity and relative proportions of terrigenous, biogenic, and authigenic material potentially available for injection into the deep basins, and is controlled by the two quasi-resident high-pressure atmospheric circulation cells (anti-cyclones) that lie on either side of southern Africa. One over the south-west Indian Ocean and the south-eastern seaboard of Africa supports a high-energy relatively low-productivity western boundary surface current (Agulhas) adjacent to the humid hinterland of south-east Africa, while the*

<sup>436</sup> Seibold n357 p79

<sup>437</sup> ibid p129

<sup>438</sup> ibid p74, Seibold n357 p89

<sup>439</sup> Kennett n383 p287

<sup>440</sup> ibid p427-441

*other over the south-east Atlantic is associated with a low-velocity high-productivity eastern boundary surface current (Benguela) adjacent to the arid hinterland of south-west Africa.*<sup>441</sup>

On the western side of southern Africa, reasonably high depositional rates have existed for a long period of time. This is due to the sediments carried by the rivers in the area, notably the Orange River.

*Sediments as thick as 7 km buried the fragmented continental basement and adjacent oceanic basement off the west coast and formed a broad continental rise and abyssal plain within the Cape Basin. The source of much of this siliciclastic debris is believed to be the Orange River.*<sup>442</sup>

and

*The Orange River Basin was the main depocentre for the Mesozoic and Tertiary sediments in the SE Atlantic Ocean (Cape Basin), and was initiated during the continental separation between southern Africa and South America in Lower Cretaceous times.... The bulk of these sediments are terrigenous and are generally assumed to have been derived from the adjacent continent via the palaeo-Orange River.*<sup>443</sup>

### **The Agulhas Bank and Plateau, and the Mozambique Ridge**

The Agulhas Bank is situated off the southernmost cape of Africa and extends, as a natural prolongation of the continent, to about 200 nm from the coast. The bank is relatively gently shelving and extends to a shelf break of about 200 metres.

*Beyond the continental margin and the adjacent Natal Valley deep, there are other major features with poorly understood origins. South of the Agulhas Bank, the Agulhas Plateau is an extensive crustal block standing relatively high above the surrounding basins. Rising from a base approximately 5 km deep, its shoaler parts reach depths around 2.5 km.*<sup>444</sup>

The Agulhas Plateau was considered, by Dingle and Klinger, to be a continental plate and that the Plateau was created as a result of breaking away from the southern African continent during the rifting of Gondwana.<sup>445</sup> Detailed geological and geophysical surveys over the southern part of the Agulhas Plateau were undertaken, in 1978, by the research vessel RV *Vema*. A published report of the findings of the research states:

*We report here that the structural framework of the Plateau and the results of a suite of refraction profiles, which indicate that significant parts of the southern plateau are composed of continental crust.*<sup>446</sup>

A previous American expedition has reported that at least some of the granitic rocks, from the southern prominences are 1 000 million years old. This means that part of the Plateau is definitely continental.<sup>447</sup> This could be of marked importance to a Continental Shelf claim such as the

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<sup>441</sup> R V Dingle (ed) "Deep Sea Sedimentation Environments Around Southern African (South East Atlantic and South West Indian Oceans)" Annals of the South African Museum Vol 98 Part 1 (1987) p3

<sup>442</sup> Emery n410 p3

<sup>443</sup> RV Dingle & QB Hendey "Late Mesozoic and Tertiary Sediment Supply to the Eastern Cape Basin (SE Atlantic) and Palaeo-Drainage Systems in Southwestern Africa" Marine Geology Vol 56 (1984) p13-15

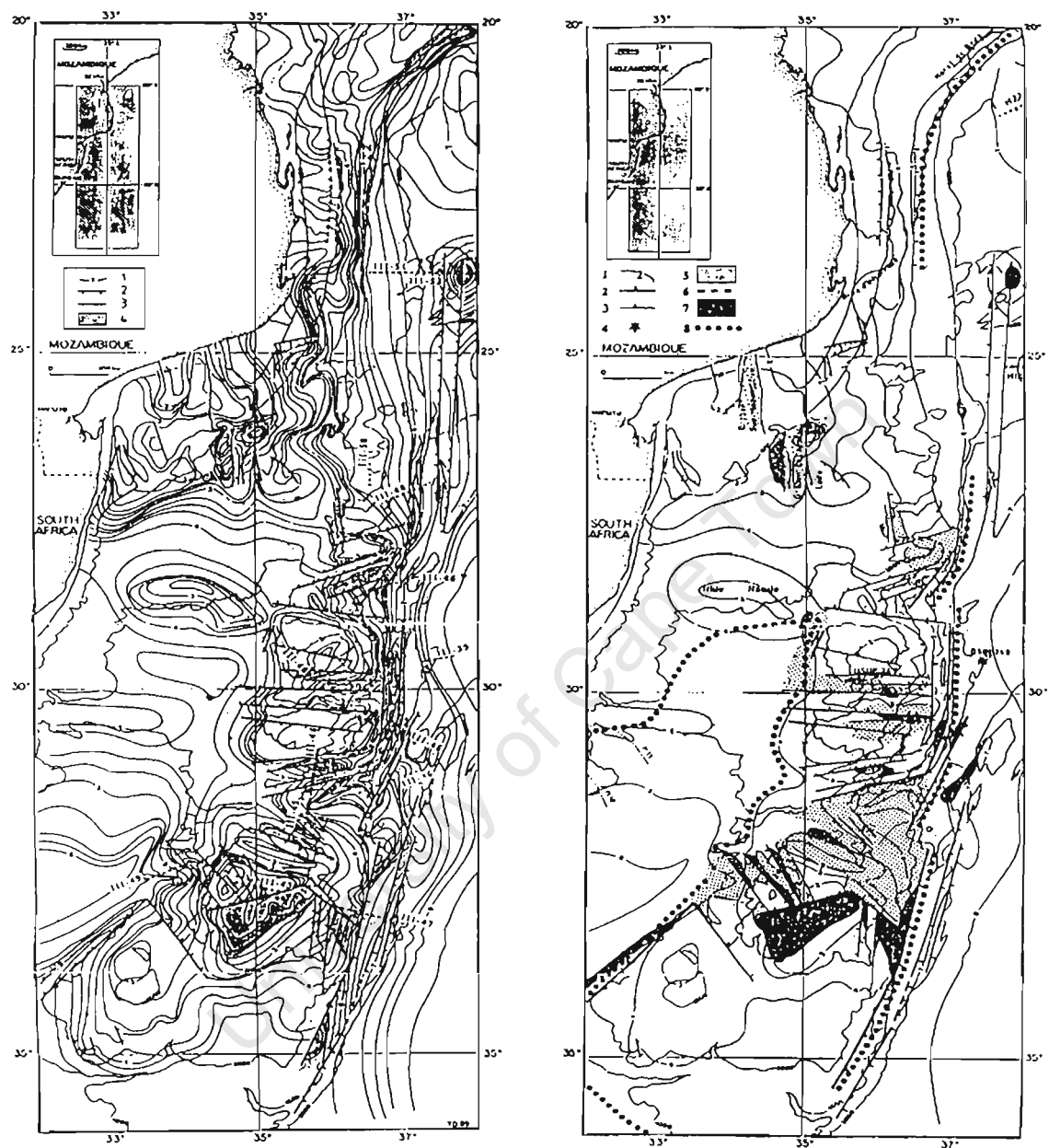
<sup>444</sup> Hartnady n413 p535

<sup>445</sup> RV Dingle & HC Klinger "Significance of Upper Jurassic Sediments in the Knysna Outlier (Cape Province) for timing the Breakup of Gondwanaland" Nature: Physical Science, Vol 232 (1971) p37-38

<sup>446</sup> BE Tucholke, RE Houtz & DM Barrett "Continental Crust Beneath the Agulhas Plateau, Southwest Indian Ocean" Journal of Geophysical Research Vol86 (1981) p 3794, ESW Simpson & AEF Heydorn "Vema Seamount" Nature Vol 207 No 4994 p249-251

<sup>447</sup> Hartnady n413 p535, Tucholke n445 p3791-3806, R Allen & B Tucholke "Petrology and Implications of Continental Rocks from the Agulhas Plateau, South West Indian Ocean" J Geophys Res Vol 86 (1981) p463-468

Mozambique Ridge, which is probably the only natural prolongation of the continental landmass of southern Africa that could extend beyond 200nm.



**Figure 19 DETAILED STRUCTURES OF THE MOZAMBIQUE RIDGE**

1-Isobaths	1-Isobaths	5-Lower Cretaceous Basins
2-Principal Faults	2-Principal Faults	6-Substrata Outcrops
3-Secondary Faults	3-Secondary Faults	7-Limited Oceanic Crusts
4-Substrata Outcrops	4-Drill-sites DSDP	

The southern parts of the Agulhas Plateau and the Mozambique Ridge are Mesoproterozoic (1600 Ma- 900 Ma) or older microcontinental fragments embedded within oceanic crust of Early Cretaceous (144 Ma- 100 Ma).<sup>448</sup>

High sedimentation rates occur off both the Zambezi and Limpopo Rivers. (See also Page 103) This has resulted in high rates of deposition south of Mozambique, east of the Mozambique Ridge. This Ridge is thought to be connected to the continent on either side of the South African/Mozambique border and could form a natural prolongation of the continent. The origins of the Ridge have not been definitely ascertained, although its continental origin was substantiated by dredge hauls at two sites.<sup>449</sup>

The continental origin of the ridge, proposed by some authors, is confirmed by dredge hauls at two other sites which yielded many samples of continental rocks. Two kinds of basement were identified: (1) fragments of Archaean basement, similar to the Zimbabwe craton, made of anorthosites, gneiss and metagabbros; (2) kinzigites, bearing garnets and sillimanites that are characteristic of the Precambrian Namaqualand orogeny. Each of the dredged rocks supports the conclusion that the Mozambique Ridge might be a continental fragment of Africa.<sup>450</sup>

### SEDIMENT TRANSPORTATION

Rivers are amongst the largest transporters of lithogenic sediment to the coast. It is generally considered that up to 85 per cent of the total sediment is transported in this manner.<sup>451</sup> In addition to sediment transportation, other processes are present and active and affect the nearshore area. Some of these processes are winds, tides, currents and waves. The areas and amounts of deposition are dependent on these factors and the type of sediment transported, the configuration of the coast and the seabed and the volume and velocity of the river.

The Indian-Pacific Ocean and Atlantic Ocean water masses meet and mix off the southeast African continental margin. The deep North Atlantic Deep Water (NADW) and Antarctic Bottom Water (AABW) and the surface Agulhas Current are fully concentrated in this region and flow in opposing directions

*...there is probably no other place on Earth where the fluctuating strength of interocean circulation may be so sensitively recorded by erosional-depositional processes on the subjacent seafloor,...*<sup>452</sup>

The sediment in this area is considered to be approximately 3 km thick.<sup>453</sup>

It is estimated that the Huang Ho, Ganges, Brahmaputra and the Yangtze rivers are responsible for 75% of the world's sediment deposition. Three of the twelve major river systems, Amazon, Indus and the Ganges- Brahmaputra are the only systems that do not deposit their sediment in marginal seas. Most other major systems have sediment trapped in estuaries, deltas or offshore basins.

<sup>448</sup> Z Ben-Avraham, CJH Hartnady & AP le Roex "Neotectonic activity on continental fragments in the Southwest Indian Ocean: Agulhas Plateau and Mozambique Ridge." Journal of Geophysical Research Vol 100 No B4 (1995) p6199

<sup>449</sup> D Mougnot, M Genesseeux, J Hernandez, C Lepvrier, J-A Malod, S Raillard, J-R Vanney et M Villeneuve "La ride Mozambique (Océan Indien) : un fragment continental individualisé lors du coulisement de l'Amérique et de l'Antarctique le long de l'Afrique de l'est?" Compte Rendu de Academie des Sciences. Paris, t. 312. Serie, (1991) p656, B E Tucholke & R W Embley "Cenozoic Regional Erosion of the Abyssal Sea Floor off South Africa": Interregional Unconformities their Documentation, Causes and Uses. Memoir American Association of Petroleum Geology Vol36 (1984) p147

<sup>450</sup> Mougnot n450 p656

<sup>451</sup> Kennett n383 p288

<sup>452</sup> Z Ben-Avraham, TM Niemi & CJH Hartnady "Mid-Tertiary changes in deep ocean circulation patterns in the Natal Valley and Transkei basin, Southwest Indian Ocean " Earth and Planetary Science Letters 121 (1994) p639

<sup>453</sup> Dingle n417 p1468

The Congo River deposits almost all of its sediment beyond the continental shelf, which it bypasses by way of the Congo Canyons.<sup>454</sup> The sediments are deposited in the Angola Basin through the canyons and possibly through the Romanche Deep, which is the only access for the AABW, which settles at the bottom of the Basin and makes a long detour to achieve this.<sup>455</sup> It can be expected therefore that sediments found far offshore on the margin, as a result of sea-level change and the deposition from major rivers could affect a LOSC continental shelf claim. High sedimentation rates could also be responsible for the formation of banks and low-tide elevations in the vicinity of the river mouth.

The Zambezi and Limpopo Rivers are responsible for significant deposition in the Mozambique Basin on the south-eastern portion of the African continent. ( See Page 102)<sup>456</sup>

## BEACH DYNAMICS.

As the position of the low-water line is vital to delimitation, the dynamics of the coast, which could affect this is important. In addition to sedimentation from rivers, beaches can be affected by the following;

- a) the action of waves, currents, and tides;
- b) storms and high winds.

Waves, currents, tides, storms and high winds can be responsible for both erosion or accretion. They could be responsible for the deposition of sediment and later for its retransportation and redistribution elsewhere. Wave action commences with the near-circular orbits of water particles that decrease in diameter of the motion below the surface. Wave length  $\lambda$  is the distance between the crests of successive waves and the water particle orbits usually die out at depths of approximately  $\lambda/2$ . Deepwater wavelength ( $L_0$ ) can be determined by  $L_0 = 1.59 T^2$ , where  $T$  is the period of the wave action in seconds of time. The maximum depth of the wave-action (wave-base) is  $\lambda/2$  and this is the depth at which the wave action 'feels bottom'.<sup>457</sup> The wave will then slow and steepen and at depth  $\lambda/20$  the wave will break.<sup>458</sup> The maximum depth to which sand is moved is 10-20 metres, but in exceptionally strong storms wave motion can reach considerably deeper and has been known to reach the shelf-break, which is usually at 200 metres depth.<sup>459</sup>

Sand that is deposited on the shelf is moved about in the area by the influence of wind-driven waves, but eventually it moves into deeper water.<sup>460</sup> Variations in salinity control the direction of currents on the shelf, but at the shore the direction of the waves governs the currents.<sup>461</sup> The currents set up by wave action are responsible for the lateral movement (longshore) of the finer-grained sediment, whereas the coarser material is moved by the wave action itself.<sup>462</sup> The longshore lateral movement (littoral drift) takes place in two ways. The first is along the beach in the upper limit of the wave action and is caused by the swash and backwash of the waves. Waves that approach the beach at an acute angle (swash) are returned at right angles to the beach in the backwash. The accumulative result of this saw-tooth effect is a longshore current that runs parallel to the beach. The second movement is in the surf and breaker zone where, as a result of the turbulence, the largest amount of material is in suspension. This material is then more readily available to be carried by the

<sup>454</sup> ibid p289

<sup>455</sup> Seibold n357 p121

<sup>456</sup> V Kolla, S Eittreim, L Sullivan, JA Kostecki and LH Burckle "Current-controlled abyssal microtopography and sedimentation in the Mozambique Basin, southwest Indian Ocean" *Marine Geology* 34 (1980) p171-206

<sup>457</sup> ibid p102

<sup>458</sup> HJG Baretta-Bekker, EK Duursma & BR Kuipers (eds) *Encyclopedia of Marine Sciences* 2<sup>nd</sup> Ed (1998) p342

<sup>459</sup> ibid p103

<sup>460</sup> Emery n397 p41

<sup>461</sup> ibid

<sup>462</sup> Zenkovich n431 p16 Press n358 p 270-272

weaker longshore currents.<sup>463</sup> Coarser material is more mobile than the finer-grained sand. This could be due to the fact that the beach gradient of coarser material is usually steeper and the action of the waves has a greater effect.<sup>464</sup>

*Although primarily related to the beach permeability, the slope shows a strong correlation with grain size because permeability is determined by grain size. It will be noted that the loss of run-up due to discharge into the beach is ten times greater for beach grains 4mm in diameter than for 1mm.<sup>465</sup>*

During summer and other constructive periods, the beach is built up. During winter and periods of storms, the beach is denuded again and deposited on an offshore bar. The amount of material moved has been found to be relatively constant when considered over longer periods of time.<sup>466</sup> If the erosion and accretion is extensive, the amount and state of the beach is as important as the state of the tide. The offshore bar is similarly affected in the summer and winter seasons by erosion and replenishment actions respectively.

Waves have a very obvious effect on the coast. They are considered to be the main factor in any alteration of a coast.<sup>467</sup> In the winter they erode the beaches and rocks and in summer they deposit sediment in the area. The forces responsible for the action of waves are not particularly important from the perspective of LOSC, but the results of wave action often impacts on the seasonal position of the low-water line, which is important in delimitation. Steep rocky coasts are undercut by wave-action resulting in a notch at sea level. This then results in slumping as the notch deepens and gravity forces the overhang to collapse. For example the coast of Tanjung Mebulu on the island of Bali, in Indonesia, is undercut to the extent that the portion of the cliff immediately above the notch is seaward of the low-water-line and the top of the cliff, which overhangs its base, is still further seaward. The position of the baselines, most advantageous to the State, would, therefore, be the edge of top of the cliff and not the low-water-line or straight baselines drawn to it. Its fate, however, is to eventually collapse.

## BAYS.

Waves reduce in speed as they approach capes or promontories. When a wave approaches the mouth of a bay it will retain its speed and break on the headlands of the bay. The waves will always be relatively higher on headlands than in bays. The immediate effect is that little deposition but considerable erosion occurs on the headlands, whereas substantial deposition will occur evenly along the shoreline of the bay.<sup>468</sup>

## MARINE CURRENTS

There are two types of marine current. There are the currents that occur at the same time as the wave and for the same reasons. (Figure 20) These currents are responsible for the transportation of significant amounts of sediment in an area. The second type of current is not the result of wave action, but is linked with wind currents that are superimposed on the wave action. In all cases, either as a surface rip current, or as a bottom current, or as a combination of both, the water is returned to the sea (Figure 20).<sup>469</sup> The extent of the energy of the bottom current is not comparable with the amount of energy expended on the beach by wave action. Not all of the water involved in this action returns to

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<sup>463</sup> King n306 p144

<sup>464</sup> ibid p247

<sup>465</sup> F P Shepard Submarine Geology (2nd Ed)(1963) p170-171

<sup>466</sup> ibid p253

<sup>467</sup> Zenkovich n431 p13

<sup>468</sup> ibid p57/58

<sup>469</sup> ibid p61, Press n358 p204-206

the sea. Wave action incorporates a significant amount of the water in the area in repeated wave action.<sup>470</sup>

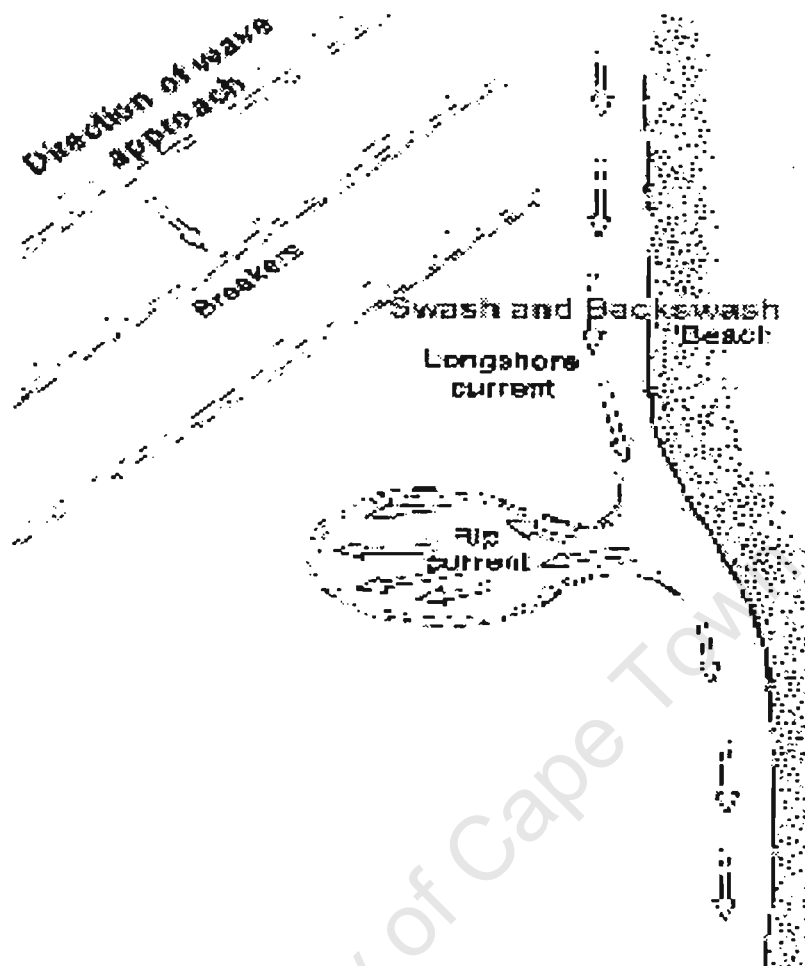


Figure 20 LONGSHORE CURRENTS AND RIP CURRENTS IN THE NEAR-SHORE REGION

### Rip Currents

Rip currents are returning surface currents in the surf-zone. They are more noticeable than the bottom currents as they carry with them the turbulent water from the broken wave. This could be visible as turbid water or spume. These currents move seawards through the surf zone, but are periodic or intermittent and their position off the coast often varies. They are visible as zones of no breakers in deepblue water. These currents cause local erosion of a sandy bottom and it is possible to have marked changes in the beach in a short period of time.

*this relief is, however extremely unstable and can alter in a few hours.*<sup>471</sup>

### Unstable Coastlines

In an unstable area of the coast, erosion or accretion could seriously affect the delimitation of marine zones. Constant change in the low-water line may require the adoption of straight baselines. For these baselines to receive international acceptance the reasons for their adoption should be clear and convincing. To provide these, the actions of the near-shore zone must be known. Wave-abrasion is the term used for the destruction of rock by the activities and action of waves.

<sup>470</sup> Zenkovich n431 p62

<sup>471</sup> ibid p65



The two results of this are;

- a) 'cliff', where a steep slope meets the water's edge;
- b) 'bench', which is a gentle sloping of the bedrock worn by the sea, seaward of the cliff;
- c) 'notch', where the base of a cliff is undercut by the eroding action of waves.



**Figure 21      UNDERCUTTING OR NOTCHING :TANJUNG MEBULU, BALI,  
INDONESIA**

**(The overhang of cliff top is not very obvious from the angle of the photograph)**

The action is not confined to the water's edge, but occurs below the surface as well. The effect decreases with depth, but may be significant when attempting to establish the position of the lowest tide by profiling.<sup>472</sup> The transportation of material of all grades can be extensive. Mineral analysis has shown that sand grains have been transported southwards by longshore drift from the coast of Labrador to the beaches of Florida, a distance of over 3000 km.<sup>473</sup>

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<sup>472</sup> ibid p147

<sup>473</sup> ibid p347.

## BARRIERS

It is possible for marine deposits to straighten a coastline by one of two methods.

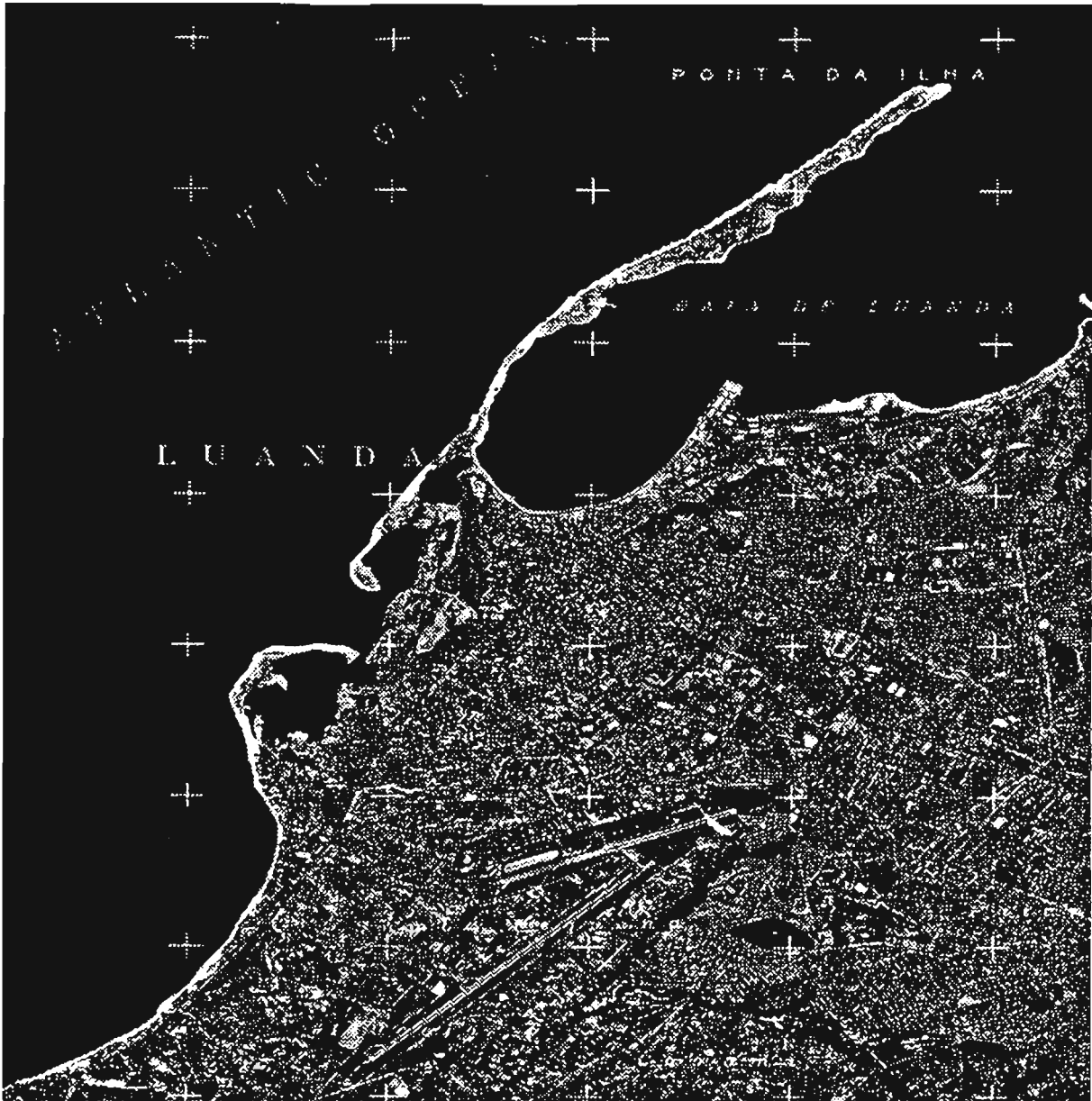


Figure 22

### BARRIER SPIT : BAY OF LUANDA

#### Barrier Spits.

Barrier spits are attached to a rocky promontory or cape and are formed as a result of a sharp change in the direction of the rocky coast at that point. This is evident on the West Coast of southern Africa, where the longshore drift transports material brought into suspension by the powerful wave action in the area and moves it in a northerly direction.

Sand barrier spits are formed on many of the capes in this area and the spits lie in a south-north direction, parallel to the beach. This has occurred at Lüderitz, Walvis Bay, Baie dos Tigros and other points on the Namibian and Angolan coasts, and also, previously, at Sandwich Harbour, and Conception and Meob (Mutzel) Bays, in the geologically recent past.<sup>474</sup>

<sup>474</sup> SAN HO 21n191 pl-30, 3-49

## **Barrier Islands.**

Barrier islands and low-tide elevations are caused by the deposition of material in front of the breakpoint of the wave and its wash effect. They are not attached to the mainland but are above high tide. In turn the beach may be backed by dunes, which may form barriers for coastal lagoons, such as are found along the Gulf of Mexico and on the East Coast of the United States.<sup>475</sup>

## **Beaches**

A beach is the accumulation of loose material of various grading around the limit of the wave action. These limits are considered to be from the land limit of the wave action to the 'wave base', the depth at which waves from the deep water begin to have an effect on deposits on the seabed.<sup>476</sup> There are five major beach material types, clay, silt, sand, pebbles, cobbles and boulders. They range from clay (< 2 microns), which is smooth to the touch and has plasticity but no dilatancy, to boulders larger than 256mm in size.<sup>477</sup> Sand is most common in beach deposits. It may include rock fragments, such as is found in the black basaltic beach sands of Hawaii.<sup>478</sup> In tropical areas beaches consist of calcareous skeletons of molluscs, corals and coralline algae.<sup>479</sup>

Clay is usually associated with continental shelves and deep-sea floor, but substantial deposits of clay and silt are found, relatively close offshore. Beaches around the mouth of the Amazon River consist of silt and clay.<sup>480</sup>

The changes in the level of the seas and oceans could be caused by climatic changes or changes to the sea basins as a result of tectonic activity. These changes coupled with the very small vertical changes that take place in the earth's crust, are between tenths of a millimetre and a few millimetres per year.<sup>481</sup> They sometimes cause significant changes to a coastline. It is common to refer geologically to an incursion of the sea onto the land as a transgression and to a regression when the coastline recedes during a fall in relative sea level. These changes affect the coastal processes in the short term. If the change is substantial or prolonged they affect the structure of the coastal area.<sup>482</sup>

## **Sand Bars**

The low-water line on a low-tide elevation, within the breadth of the territorial sea, may be used by a coastal State to determine the outer limits of its maritime zones.<sup>483</sup> The low-tide elevations could be rocks, offshore reefs or sandbars or spits. The rocks and reefs are relatively stable. While they may suffer erosion, this will usually take place over a long period of time. Sand bars and spits could change their shape and position with each tide. They are particularly susceptible to powerful wave or storm action.

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<sup>475</sup> Seibold n357 p140

<sup>476</sup> CAM King Beaches and Coasts (1961) p1

<sup>477</sup> *ibid* p3

<sup>478</sup> Seibold n357 p80

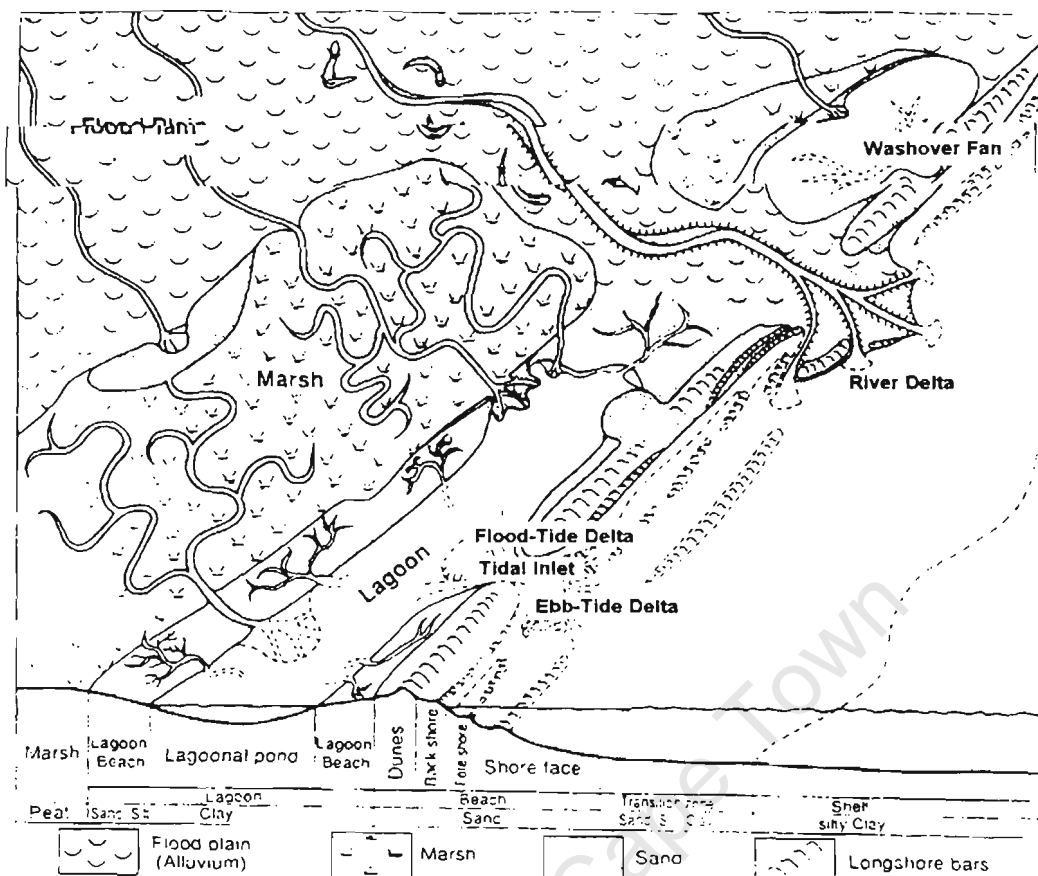
<sup>479</sup> *ibid*

<sup>480</sup> *ibid* p66-67, 73-75

<sup>481</sup> *ibid* p527, Press n358 p254 & 532

<sup>482</sup> King n473 p528

<sup>483</sup> LOSC Article 13



**Figure 23 GEOMORPHIC FEATURES OF A BARRIER-TYPE COAST**

In some cases sandbars may be found parallel to a coast for tens and sometimes hundreds of kilometres. They are to be found on all types of coast including non-tidal seas and lakes.<sup>484</sup>

A beach profile is subject to many factors some of which are the following;

- a) the type of material that makes up the beach. Shingle or gravel beaches react differently to wave and other actions than a fine sand or boulder beach;
- b) the existence and depth of rock beneath the seabed;
- c) the prevailing wind, weather and wave patterns.

*Striking differences exist between the gravel or shingle beaches, coarse sand beaches and fine sand beaches. The typical gravel beach has a beach ridge on the inside where the waves have piled up the gravel ridge as much as 20 ft above normal high tide.....Often the slope is interrupted by the step near the low tide line*

*Coarse sand beaches may have berms but these berms slope landwards often at considerable angles. The foreshore is steep, although somewhat less so than found in gravel beaches.*

*Fine sand beaches differ from the others chiefly in having very gentle foreshore slopes.*<sup>485</sup>

<sup>484</sup> King n473 p220

<sup>485</sup> Shepard n462 p170/171

## Beach Barriers

Estuaries and lagoons usually have a barrier at the mouth which is built up by the deposition of sediment from the estuary or the lagoon, but far more likely by material from the beach area deposited by wave and longshore currents. These barriers are periodic and are dependent on prevailing weather and wave action. A good example of this is found at the mouth of the Bot River, approximately 50 nm east of Cape Town.<sup>486</sup>

At times of heavy rain the estuary or lagoon may, by the seaward pressure of the lagoonal water, destroy a barrier that has blocked the tidal inlet. Heavy wave action brought on by wind or weather could also be responsible for the erosion of the barrier.<sup>487</sup> These barriers are therefore as unstable as some of the sandbars that are used as low-tide elevations. LOSC has made provision for straight baselines to be drawn across unstable deltas. The baselines must be co-ordinated and can remain as the baseline even if the barrier recedes towards the land.<sup>488</sup> Article 9 makes provision for straight baselines to be drawn across the mouths of rivers that flow directly into the sea. There are very few rivers that do this. Most large rivers, where the drawing of a straight baseline would be of significance, flow into the sea via estuaries or river deltas.

## RIVER DELTAS

Deltas consist of complex distributary channels of a river with natural levees and lakes and swamps in interdistributary bays (Figure 23). As the delta extends seawards its gradient decreases and the river is able to find shorter distances to the sea. The river will then shift its course (avulse) to another distributary channel and another delta lobe is created.<sup>489</sup> The best example of this is the Mississippi Delta.<sup>490</sup>

River deltas are formed jointly by fluvial and marine agencies. This occurs, usually, at the mouths of large rivers, where significant amounts of material are brought down in bedload, or suspended-load, during times of flood. This material is deposited offshore and as the sea bottom is built up it impedes wave action. This results in the river deltas prograding seawards at a rate that is measurable by the use of charts over a period of time.

There are various types of deltas that develop differently depending on the comparative strengths of river and the wave action. The best example of the fluvial-dominated delta is the Mississippi Delta. These deltas are characterised by highly irregular and protruding shorelines, a sparsity of wave-built features and low lateral continuity of sands. The Senegal Delta is a wave-dominated delta and exhibits straight shorelines characterised by well-developed barriers and beach ridges with high lateral continuity of sands. A third category is illustrated by the Ganges-Brahmaputra Delta which is tide-dominated.<sup>491</sup>

River deltas are dynamic areas of a coast and subject to constant change. Sometimes the coast progrades seawards (active lobe) and in other areas the size of the river delta is reduced (abandoned lobe). LOSC provides for this event in Article 7(2). The Mississippi Delta is the prime example of a river-dominated delta with active lobes. East of the Mississippi Delta are the Chandeleur

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<sup>486</sup> J Rogers "Geomorphology, Offshore Bathymetry and Quaternary Lithostratigraphy Around the Bot River Estuary" Transactions of the Royal Society of South Africa Vol 45 (1985) p211-237

<sup>487</sup> *ibid* p284

<sup>488</sup> LOSC Article 7(2)

<sup>489</sup> Hill n323 p629/630

<sup>490</sup> Shepard n462 p215

<sup>491</sup> LD Wright & JM Coleman "Variations in Morphology of Major River Deltas as Functions of Ocean Wave and River Discharge Regimes" The American Association of Petroleum Geologists Bulletin Vol 57 No2 (1973) p370 J Rogers & JM Bremner "The Benguela Ecosystem, Part VII- Marine Geological Aspects" Oceanography and Marine Biology Annual Review 29 p1-85

Islands, barrier islands that have active wave erosion on an abandoned lobe.<sup>492</sup> It is also possible to have a small distributary mouth sand bar seaward of the river delta.<sup>493</sup>

Small rivers usually have lower runoff and load and the shape and type of mouth depends on the sea conditions into which the river discharges. Where wave action is high, the load transported by the river must be high to have an influence at the mouth. The development of the coastal area is dependent on material being transported and, if this amount is small, the sea conditions may denude the coastal area of sedimentation. Where there is a balance between the amount of sediment, the intensity of the sea conditions and land subsidence there is usually a maintenance of the coast by the sea and where there is greater sediment supply than wave action can disperse, then deposition and an increase in the land (progradation) occurs.<sup>494</sup>

In the Mississippi Delta, which is river-dominated, the following is an indication of the sediment rates that are critical in this area. As the southern African coast is wave-driven this is of minor importance.

*In an area that is apparently maintaining its surface with respect to sea level, Cs dating shows an accretion rate of 1.35 cm/yr. In an adjacent deteriorating marsh the sedimentation rate is 0.75 cm/yr, not enough to compensate for subsidence.*<sup>495</sup>

The low-water line is the major factor from which the zones are measured and these lines are to be found mainly on the beaches of a coastal State, at its river mouths and around its low-tide elevations. According with LOSC,<sup>496</sup> the low-tide elevations, without structures on them, may not be utilised as basepoints for straight baselines. With accretion or erosion, a low-tide elevation could become permanently above highwater and be regarded as an island, in terms of LOSC, or an above-high-tide sandbank, which is considered as an island, could become a low-tide elevation. It is vital, therefore, that a coastal State monitor the actions and forces in operation at its coast to ensure delimitation to its best advantage.

## DEEP-SEA FANS

Fed by turbidity currents from submarine canyons, deep-sea fans, on the continental rise, are deep-sea features that consist of overlapping fans of sediment divided by channels. They are subsequently filled by further sediment deposition. They could be rich in hydrocarbons.<sup>497</sup> Their potential as a possible source of submarine resources will be considered in Chapter XI.

## SEAMOUNTS AND GUYOTS

Whereas the existence of seamounts has been known for a long time, knowledge of the extent and number of these features was not possible until the advent of deep-sea single-beam echo-sounders, multibeam-swath echo-sounders and deep-water sidescan sonar, such as the Geological Long Range Inclined ASDIC (GLORIA). Sidescan sonars will be considered in Chapter VII.

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<sup>492</sup> *ibid* p191, 215-221

<sup>493</sup> *ibid*

<sup>494</sup> Hill n323 p558

<sup>495</sup> RD De Laune & WH Patrick "Rate of Sedimentation and its Role in Nutrient Cycling in a Louisiana Salt Marsh" P Hamilton & KB Macdonald (eds) *Estuarine and Wetland Processes with Emphasis on Modelling Marine Science* Vol 11 (1979)

<sup>496</sup> LOSC Article 7(4)

<sup>497</sup> Kennett n383 p30, 410-415, 421

A seamount is distinguished from a guyot by the fact that its top is sharp-crested whereas the guyot has a flat top. It is estimated that there over 10 000 seamounts and guyots in the Pacific alone.<sup>498</sup> These features originated as a result of volcanic activity on the seabed and some of them rise 3 000 metres from the seabed to above the surface. (Figure 24) The Vema Seamount, in the Cape Basin west of Namaqualand, is approximately 5 000 metres high. It is approximately 35 miles in diameter at ocean floor level and the overall slope inclination is 1 in 4 or 15 degrees. The top is 5 miles in diameter and is generally at a depth of approximately 75 metres with the shallowest being over a peak at approximately 25 metres. The sides are steeper and higher than their land-based counterparts and this could have been as a result of the molten lava solidifying faster in the cold, high-pressure, sea water.<sup>499</sup>

Many of these features never reach the surface, and it is only those that are above high tide and are sovereign territory of a State or, as in the case of Iceland, a sovereign State in its own right that can influence a delimitation. If they are above high-tide they are regarded as islands in terms of LOSC.<sup>500</sup> A factor that could alter the effect that would have on delimitation is the possibility of a fluctuating sea-level or a subsiding seafloor. This could make them permanently above a high-tide or a low-tide elevation. Features of guyots indicating possible differences with atolls are;

*They have rather flat tops, but differ from atolls in that the highest point of guyots is near the centre of the top, the highest point of atolls being at the edges of the atoll; the edges of guyots are rounded, those of atolls sharp. The rocks on the top of some guyots are a mixture of rounded basalt pebbles and sandstone, together with fauna including reef-corals, rudistids, and Mollusca; the fauna is Cretaceous in age. The reef corals suggest that water, in which they formed, was shallow, and the rounding of a number of basalt pebbles suggest that erosion by waves occurred at some time, which led to the shelf-like top.*<sup>501</sup>

Hess, who originally discovered and named guyots, proposed that guyots were originally volcanic islands formed as a result of 'hot spots' in the mantle below oceanic crust. They were subsequently truncated by the erosion power of wave action into this flat-topped type of seamount and sink as a result of seafloor spreading, as the oceanic crust moves past the 'hot spot', cools becomes denser and sinks.<sup>502</sup>

Evidence exists of seamounts occurring in linear formations, such as the Hawaiian Chain.<sup>503</sup>

Wilson<sup>504</sup> and Morgan<sup>505</sup> hold that stationary sources of hot magma exist, deep in the mantle, over which the oceanic lithosphere rides. Volcanoes build up, on the oceanic crust, over these 'hot-spots', sites of 'plumes' of ascending magma. With the movement of the oceanic plate, a trail of volcanoes forms, with those that are moving away from the hot-spot becoming extinct and sinking below sea level. It is possible to trace the direction and the speed of seafloor spreading by comparing the positions of the chains to the positions of the near-stationary hot-spots. The seamounts submerge as a result of both the effects of erosion by wave action and of seafloor spreading, mainly the latter.<sup>506</sup>

<sup>498</sup> King n473 p70

<sup>499</sup> Simpson n445 p249

<sup>500</sup> LOSC Article 121 (1)

<sup>501</sup> Keen n363 p98

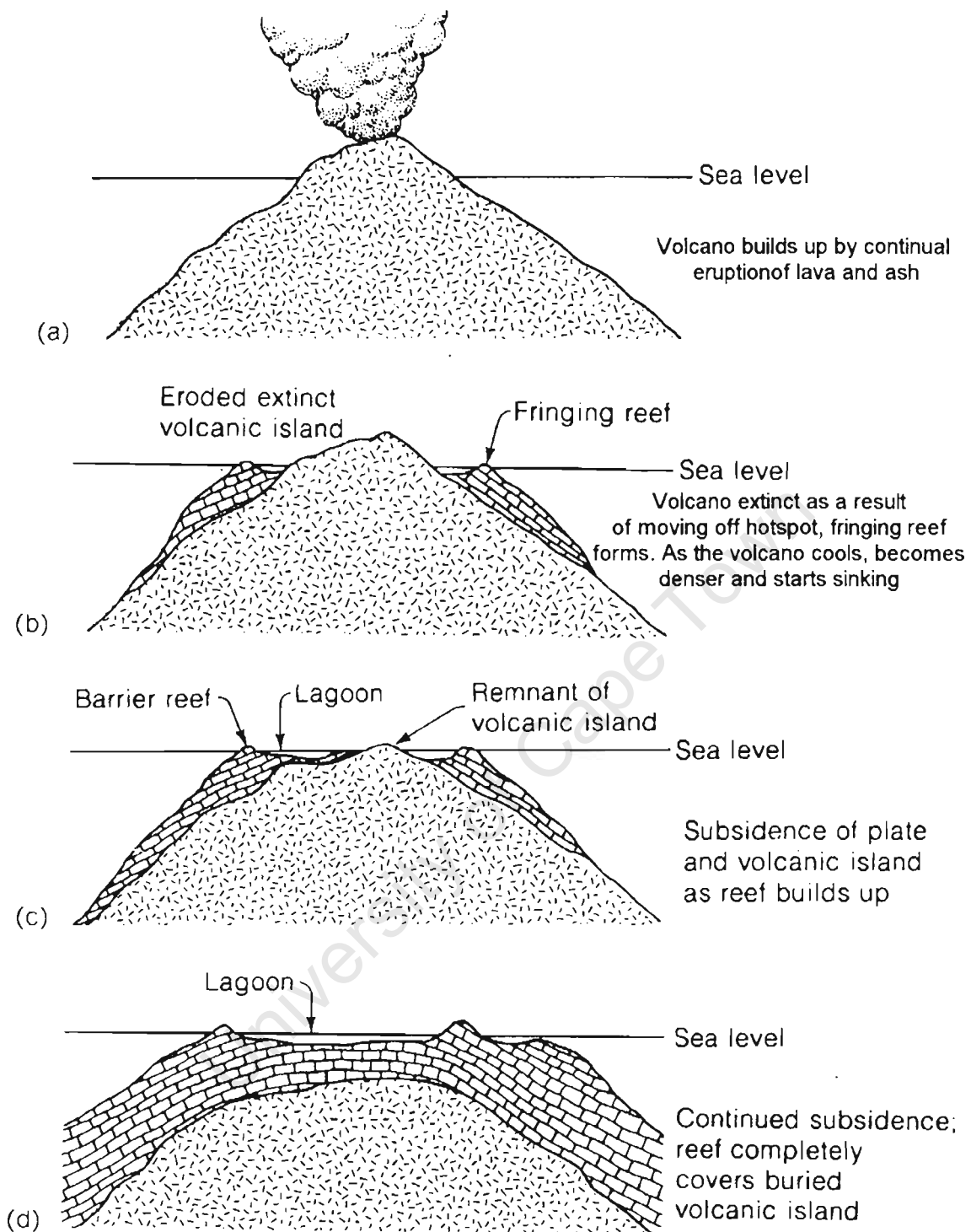
<sup>502</sup> Hess n387, Seibold n357 p29

<sup>503</sup> ibid p30

<sup>504</sup> JT Wilson "Continents Adrift" Nature. No 207 (1963) p343

<sup>505</sup> Morgan n389 p1959

<sup>506</sup> Seibold n357 p32-33



**Figure 24 THE EROSIONAL PROCESSES OF A VOLCANIC ISLAND**  
**(It becomes an atoll and finally a seamount when fully submerged)**

### CORAL ATOLLS AND REEFS

An atoll has the same origin as a seamount and a guyot. Where the seamount is formed by the steady accretion of volcanic material from a volcano on the seabed, the atoll is a seamount on which coral polyps have found a suitable breeding area. A rise in the level of the sea is a factor, which could result



in the outer limits of the coral colony forming a fringing reef as the sea rises.<sup>507</sup> LOSC makes provision for the low water line on outer reefs to be used for delimitation purposes.<sup>508</sup>

### SUBMARINE CANYONS.

The continental slope, and in some instances the shelf itself, are interrupted with submarine valleys, ravines and canyons. They do not necessarily lie at right angles to the shelf break and could be at any angle. The origin of these features is not finally agreed upon, but it is felt that some must have arisen as a result of the actions of rivers when the level of the sea was much lower, or as a result of the flow of turbidity currents.<sup>509</sup>

Similarly to seamounts, the knowledge of the existence of submarine canyons has expanded considerably in recent decades.

There are three major types of submarine canyon;

- a) small gorges, usually near the edge of the continental shelf, that run down the slope to the rise;
- b) similar canyons, starting usually at the mouths of major rivers that run across the entire continental shelf, down the slope to the deep sea-bed;
- c) a complex series of branches, similar to land-based dendritic systems. These are incised into the shelf break and the slope.<sup>510</sup>

These canyons are used for the transportation of sediment across the shelf to the deep seabed. Substantial deposits may be found on the seabed seaward of the foot of a canyon in a submarine fan. The presence of a canyon may give an indication of the presence of substantial sediments in the region. Examples are the Cape Canyon<sup>511</sup>, the Natal Canyons<sup>512</sup>, and the Hudson Canyon.<sup>513</sup>

### DEVELOPMENT OF THE SOUTHERN AFRICAN CONTINENTAL MARGIN

Off the west coast of southern Africa is a passive continental margin and the classic attributes of such a margin are evident. The South Atlantic Ocean seafloor formed as a result of seafloor spreading that has, and is, taking place along the Mid-Atlantic Ridge, a divergent plate boundary. This type of crustal activity has meant that the margin off the West Coast is passive. This margin extends as far north as the Bight of Africa.<sup>514</sup> The South West Indian Ocean Passive Margin, north of Durban, is thought to date from the separation of East and West Gondwana.<sup>515</sup>

A translational plate boundary, the Agulhas-Falkland Fracture Zone, occurs off the southeast coast of South Africa. A sheared margin has formed along this fracture zone, which has truncated the continental margin to the extent that in the coastal area between East London and Durban, the continental shelf has an average width of about five nm. In a southwesterly direction, the widest

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<sup>507</sup> ibid p74

<sup>508</sup> LOSC Article 47(1)

<sup>509</sup> Seibold n357 p62

<sup>510</sup> King n473 p65

<sup>511</sup> ESW Simpson & E Forder "The Cape Submarine Canyon Part 1 Bathymetry" Fisheries' Bulletin of South Africa 5 (1968) p35-37

<sup>512</sup> ND Bang "Submarine Canyons off the Natal Coast" South African Geophysical Journal 50 (1968) p45-54

<sup>513</sup> Shepard n462 p328-329

<sup>514</sup> ESW Simpson "Evolution of the South Atlantic" Annexe to the Transactions of The Geological Society of South Africa Alex du Toit Memorial Lecture 15 (1977) p10-11

<sup>515</sup> Dingle n417 p1468

portion of the continental shelf of southern Africa is found on the Agulhas Bank. The width to the shelf break is approximately 200 nm.<sup>516</sup>

Sedimentation on the margin is mainly the result of the amount of material discharged onto the shelf by the Orange, Olifants, Berg and Tugela Rivers, mainly in the Cretaceous Period.<sup>517</sup>

The Agulhas Current sweeps sediment along the shelf until it reaches margin-perpendicular submarine canyons.<sup>518</sup> The Agulhas Current is a powerful warm surface current, a western boundary current, that flows strongly polewards as an extension of the Mozambique Current. It transports large volumes of bedload that are swept off the narrow shelf and deposited in the adjacent basins such as the Natal Valley and the Transkei Basin.<sup>519</sup>

Extensive transportation of sediment by the Zambezi, and other rivers on the East Coast of Mozambique, is discharged onto the margin in the Mozambique Channel and the Mozambique Basin. Some of this material is deposited on the margin near the mouths of the rivers and some in a submarine fan in the Mozambique Basin.<sup>520</sup> The Mozambique Ridge is a substantial ridge that extends, from south of Beira, to a position off the Transkei coast.<sup>521</sup> The Natal Valley, located between the Mozambique Ridge and the continent, derives its sediment from the rivers of the Eastern Cape and Kwazulu-Natal.<sup>522</sup> The origin and composition of the Ridge could be as a result of being;

*located now or in the recent geological past above a hotter-than-normal region of the asthenospheric mantle.*<sup>523</sup>

Further to the south west of the end of the Ridge is the Agulhas Plateau. As a result of the Agulhas-Falkland Fracture Zone this is separated from the continent by the Agulhas Passage<sup>524</sup> and between this Plateau and the end of the Mozambique Ridge is the Transkei Basin, already mentioned, of which little is known at present.<sup>525</sup>

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<sup>516</sup> SA Nautical Chart SAN 57

<sup>517</sup> Dingle n417 p1470

<sup>518</sup> SAN HO 21 n191 p3-45, Hartnady n413 p537, BW Flemming "Sand Transport and Bed-form Patterns on the Continental Shelf between Durban and Port Elizabeth (Southeast African Continental Margin)" Sedimentary Geology 26 (1980) p179-205

<sup>519</sup> Dingle n423 p37

<sup>520</sup> Kolla n458 p 171-206

<sup>521</sup> Dingle n417 p1468

<sup>522</sup> Hartnady n413 p536/7

<sup>523</sup> *ibid* p537

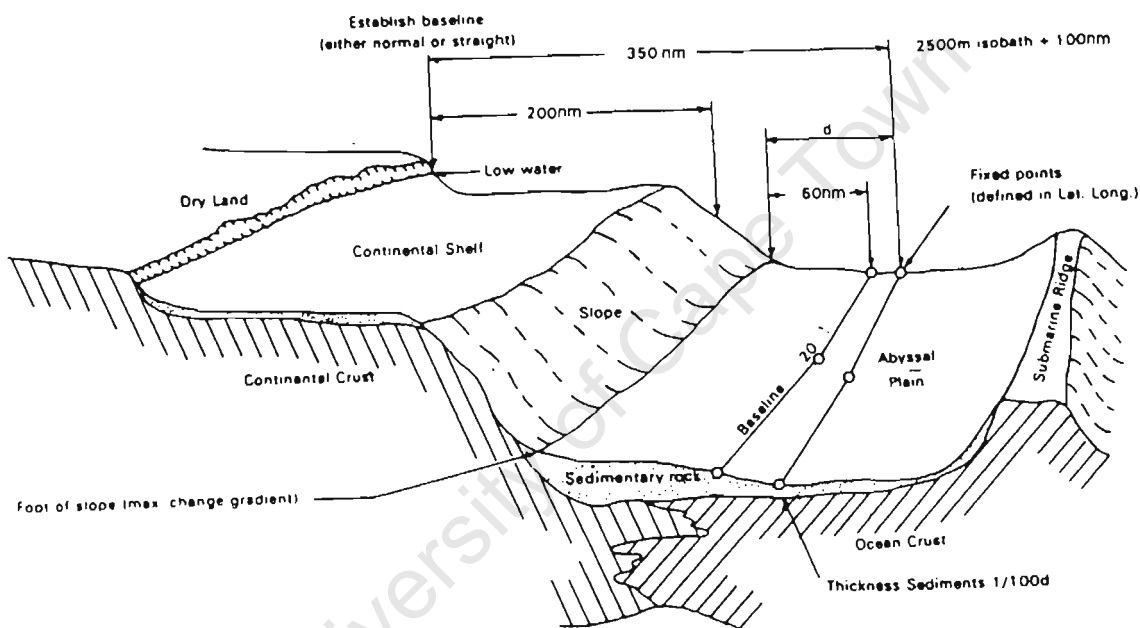
<sup>524</sup> Ben-Avraham n451 p640

<sup>525</sup> Hartnady n413 p536

(Unless otherwise stated all definitions are taken from AJ Kerr, NR Guy et al IHO Manual on Technical Aspects of United Nations Convention on Law of the Sea 1982 3rd Ed 1993.)

*As defined in LOSC as follows: 'The continental margin comprises the submerged prolongation of the land mass of the coastal State, and consists of the sea-bed and subsoil of the shelf, the slope and the rise. It does not include the deep ocean floor with its oceanic ridges or the subsoil thereof.'*<sup>527</sup>

The continental margin comprises the seabed from the coast to the end of the continental rise. It does not include the deep ocean floor.

CONTINENTAL SHELF (LOSC) <sup>528</sup>

*The continental shelf of a coastal State comprises the sea-bed and subsoil of the submarine areas that extend beyond its territorial sea throughout the natural prolongation of its territory to the outer edge of the continental margin, or to a distance of 200 nautical miles from the baselines from which the breadth of the territorial sea is measured where the outer edge of the continental margin does not extend up to that distance.*<sup>529</sup>

<sup>529</sup> LOSC Article 76 (1)

### Comment.

The marine-geological definition of the continental shelf is:

*the continental shelf forms the seaward extension of the adjacent continent from the shoreline to a line called the shelf break or shelf edge.*<sup>530</sup>

This definition restricts the outer limit of the continental shelf to that portion of the margin, where the continental slope begins with a marked change in the angle of the seabed, known as the shelf break. Due to the fact that LOSC, as contained in Article 76.1, allows for an LOSC continental shelf to extend to 200 nm, without geological substantiation, even the deep-sea bed could be included in the LOSC continental shelf. As the Article does not restrict the claiming of deep-sea bed to 200 nm from the baselines, it is in conflict with Article 76(3) and States may use this anomaly to claim deep-sea bed beyond 200 nm. This Article should be carefully considered when the requirements for an LOSC continental shelf are being considered and, in particular, the zones generated by islands that are not, geologically, a part of the continental margin.

### CONTINENTAL SLOPE<sup>531</sup>

*That part of the continental margin that lies between the shelf and the rise. Simply called the 'slope' in LOSC*

### Comment.

Marine geologists consider that the continental shelf, generally, reaches a depth of about 200m before the gradient becomes steeper and falls to a depth of between 1800 and 3500 metres. The area of the seabed at the steeper gradient is known as the continental slope.<sup>532</sup>

### Foot of the Continental Slope.

*In the absence of evidence to the contrary, the foot of the continental slope shall be determined as the point of a maximum change of gradient at its base.*<sup>533</sup>

### Comment

The foot of the slope is regarded as the end of the slope and the start of the continental rise or, if there is no rise, it would then be at the start of the deep ocean floor. It is possible to have a convoluted or multiple slope and the position of the foot of the slope that can generate the most favourable claim for a State may be difficult to position. It is important, therefore, to survey, thoroughly, that area at the foot of slope critical to a delimitation. LOSC<sup>534</sup> defines the extent of an LOSC continental shelf as being based on, whichever is the greater of, the following factors;

- a) 60nm from the foot of the continental slope. (point of maximum change of gradient at the base of the slope), (See Figure 25), or
- b) a point where sediment thickness is 1% of the distance of that point to the foot of the slope. (1/10<sup>th</sup> of distance 'd'-See Figure 25)

Neither of these factors may extend a claim beyond 100nm from the 2500 metre isobath or 350 nm from the territorial sea baselines, whichever is the greater.

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<sup>530</sup> Kennett n383 p29

<sup>531</sup> LOSC Articles 76

<sup>532</sup> Kennett n383 p29

<sup>533</sup> LOSC Article 76 (4) (b)

<sup>534</sup> LOSC Article 76

To determine the geomorphology and then the position of maximum gradient change it is necessary to have adequate bathymetry from which accurate vertical profiles of the seabed can be drawn. Where the geomorphology is complicated or, in some cases, perpetually covered in ice, seismic measurements are used to determine both the sediment profile and the foot of the slope. The Guidelines of the UN Commission on the Limits of the Continental Shelf clearly indicates the methodology to be used to determine the position of maximum change in gradient at the foot of the slope.<sup>535</sup>

### **CONTINENTAL RISE**<sup>536</sup>

*A submarine feature, which is that part of the continental margin lying between the continental slope and the deep ocean floor, simply called the rise in the Convention.*

#### **Comment**

The marine-geological definition of a continental rise is the physiological province between the slope and ocean basins and is formed by the accumulation of sediment transported from the continents and deposited at the base of the slope.<sup>537</sup> Methods of measuring both the shape and extent of continental rise are discussed in Chapter VII dealing with survey methods and their accuracy.

### **DEEP OCEAN FLOOR**<sup>538</sup>

*The surface lying at the bottom of the deep ocean with its oceanic ridges, beyond the continental margin.*

#### **Comment**

The deep ocean floor is not specifically mentioned in LOSC. It is referred to as the seabed in all the relevant Articles. Unless a part of the deep ocean floor is included in a legitimate LOSC continental shelf claim by a coastal State, it is regarded as being for the benefit of all under the concept of the Common Heritage of Mankind.<sup>539</sup>

### **NATURAL BOUNDARIES**

Natural Boundaries have not been defined in either LOSC or the TALOS Manual.

#### **Comment**

The International Court of Justice held in the Gulf of Maine Case that natural boundaries in submarine areas have a bearing on delimitation considerations and that geographical and geological factors were important for consideration in disputes, although they were rejected in this case as being 'case specific'.<sup>540</sup> It is important, therefore, that geological knowledge of the area should be obtained to ensure that every aspect can be considered, even if it is subsequently rejected.

Where arguments are made for a natural boundary to be considered as a factor in delimitation, it may still be difficult for Courts to identify the precise position of a boundary. The Timor Trough, of similar depth to the Rockall Trough, is 70 nm wide. If this is considered a natural boundary the Court would have to decide where in the 70 nm the delimitation is to be made.<sup>541</sup>

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<sup>535</sup> United Nations "Scientific and Technical Guidelines of the Commission on the Limits of the Continental Shelf" UN Document CLCS/11 (May 1999) p24-49

<sup>536</sup> LOSC Articles 76(3)

<sup>537</sup> Kennett n383 p30

<sup>538</sup> LOSC Articles: 59, 76, 77, 159, 162(2), 165(2), 185, 186, 187, 188, 194, 287, 288, 289, 290(5), A3/21(2), A6/14, A6/39, A6/25, A6/35

<sup>539</sup> LOSC Article 136, Joyner n30 p190

<sup>540</sup> Gulf of Maine Case n240

<sup>541</sup> Australia/Indonesia (Timor and Arafura Seas) 974 UNTS 319 (1957)

## NATURAL PROLONGATION

'Natural prolongation' is defined neither in LOSC nor in the TALOS Manual, nor is there a specific definition in marine geoscience. A general definition could be; So in conclusion it can be stated that the natural prolongation of a coastal State's landmass, via the coastal opening into and under the sea, includes, in a geomorphological sense of the term, that part of the continental margin (shelf, slope, and rise) which lies seaward of the particular landmass, generally allowing of no further directional or positional distinction.<sup>542</sup>

The concept of natural prolongation is contained in LOSC,<sup>543</sup> and has been used as an argument in favour of a particular delimitation.<sup>544</sup> It has been referred to in the judgements of some Courts.<sup>545</sup> Natural prolongation is a major consideration in establishing whether submarine areas can be considered to be the natural extension of a continent.

The continental crust extends seawards under the continental margin to varying extents and generally gives an indication where the seabed can be considered an extension or natural prolongation of the continent. It is a concept related mainly to LOSC continental shelf claims. Claims to the LOSC continental shelf were first given international attention through the Truman Proclamation.<sup>546</sup>

The Proclamation generated interest in natural submarine boundaries at the limit of a continental shelf. The reaction to natural prolongation, in relation to the application of marine-geological considerations in LOSC, has been varied. In the North Sea Continental Shelf Cases<sup>547</sup> it was considered juridically for the first time, and given prominence.

The Court was concerned that seaward claims made by coastal States should be over areas that have some physical connection or association with the mainland of that State.

*What confers the 'ipso jure' title which international law attributes to the coastal State in respect of its continental shelf, is the fact that the submarine areas concerned may be deemed to be actually part of the territory over which the coastal State already has dominion,- in the sense that, although covered with water, they are a prolongation or continuation of that territory, an extension of it under the sea.*<sup>548</sup>

The Tribunal in the Anglo-French Continental Shelf Arbitration<sup>549</sup> adopted a similar approach. The United Kingdom attempted to introduce the concept of a natural boundary, the Hurd Deep and the Hurd Deep Fracture Zone. These occur in the Channel as troughs or trenches. The UK requested that they be considered in preference to delimitation by the equidistant method. This was rejected by the Tribunal:

*even if they be considered distinct features in the geomorphology of the shelf, (they) are still discontinuities in the seabed and subsoil which do not disrupt the essential unity of the continental shelf in either the Channel or the Atlantic.*<sup>550</sup>

<sup>542</sup> J Lilje-Jensen & M Thamsborg "The Role of Natural Prolongation in Relation to Shelf Delimitation beyond 200 Nautical Miles" Nordic Journal of International Law Vol 64 (1995) p625

<sup>543</sup> LOSC Article 76

<sup>544</sup> K Higher "The Use of Geophysical Factors in the Delimitation of Maritime Boundaries" in Charney n235 p186-187

<sup>545</sup> *ibid* p166-170

<sup>546</sup> USProc.28 Sept 1945 59Stat 88410 Fedreg 12303

<sup>547</sup> North Sea Continental Shelf Cases n232

<sup>548</sup> *ibid* at 31 para 43

<sup>549</sup> Anglo/French Continental Shelf Arbitration n167

<sup>550</sup> North Sea Continental Shelf Cases n232 at 63 para 107

Natural prolongation features also in the Gulf of Maine Case. The US argument was based on geographic considerations and was linked to the concept of 'natural prolongation'. The argument revolved around the Georges and Browns Banks. The ecology and oceanographic conditions in the area were also advanced and included information concerning fish, their breeding habits, schooling patterns, feeding grounds, water temperatures and salinity, all in an attempt to show that there was a natural division between the two banks.<sup>551</sup>

The Court dismissed the argument, holding that the channel between the banks

*does not have the characteristics of a real trough marking the dividing line between two geomorphologically distinct units.*<sup>552</sup>

This case included a division of both territory and mobile resources, so it was unlikely that geophysical features would be able to influence the decision to the detriment of either of these two considerations.

The Conciliation Commission on the Continental Shelf Area between Jan Mayen Island and Iceland<sup>553</sup> concluded

*that the concept of natural prolongation would not form a suitable basis for the solution of the outstanding issues.*

This was based on the fact that they considered that the Jan Mayen Ridge was not morphologically an extension from the Icelandic shelf and that it was not a natural prolongation of either Jan Mayen or Iceland.

The most significant ruling by the Court with regard to the concept of natural prolongation could have been delivered in the Libya/Malta Continental Shelf Case.<sup>554</sup> Both parties submitted considerable evidence to support their claims describing the geological history and structure of the seabed in the area. Malta, being a small island, promoted the use of the equidistant principle. Libya contended that the Pantelleria Rift Zone in the seabed between the two States, indicated clearly where the natural prolongation of the two States ended.

The Court held that;

- a) the delimitation should be in accordance with equitable principles,
- b) criteria for delimitation based on the principle of natural prolongation would be considered and no claim should exceed 200 nm from the baselines,
- c) the general configuration of the coasts of the Parties, the fact that they were located opposite each other, their general geographical position, and the distance between the two States should be considered,
- d) excessive disproportion between the delimitation and apportionment of continental shelf in relation to the coastline of a coastal State should be avoided.<sup>555</sup>

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<sup>551</sup> Gulf of Maine Case n240 paras 48-55

<sup>552</sup> *ibid*

<sup>553</sup> "Report and Recommendations to the Governments of Iceland and Norway of the Conciliation Commission on the Continental Shelf Area between Iceland and Jan Mayen" (1981) 20 *ILM* 787

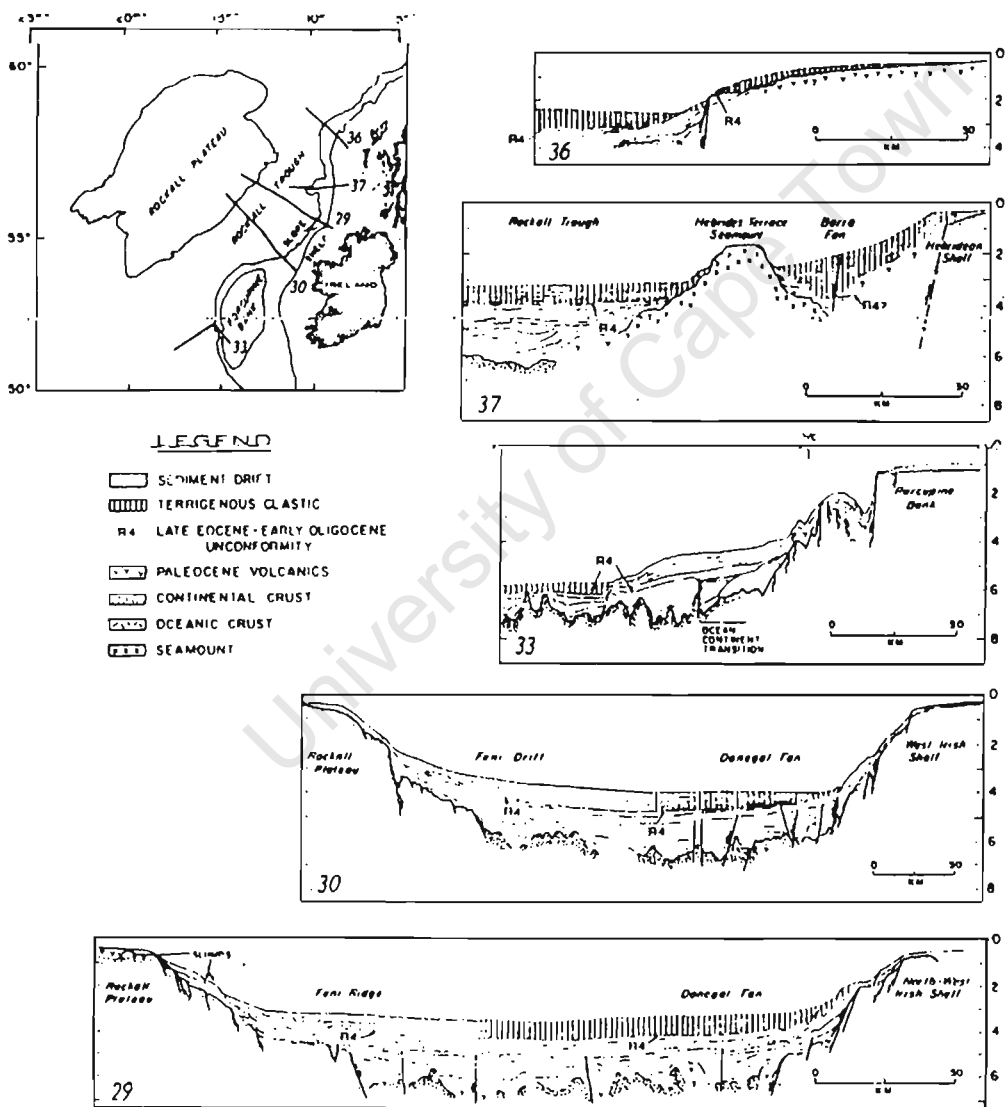
<sup>554</sup> Libya/Malta Continental Shelf Case n238

<sup>555</sup> *ibid* p57

The Court upheld the concept and applied the equidistant method, but modified it by offsetting the median line in the direction of Malta.<sup>556</sup> The Court ruled that Malta, a fully independent State, was not to be given full status as an island when the delimitation was computed, although natural prolongation was discarded as an argument by the Court. To accord less than full effect to an island, usually only occurs in the case where economically and geographically insignificant islands exert unreasonable influence on delimitation.

While it would appear that natural prolongation is not taken as a major criterion it is still a factor that will be considered.<sup>557</sup>

In the case of Rockall, the UK introduced plate tectonics into the argument. They argued that as the crust extended from the coast of the UK under the 3000 metre deep Rockall Trough, natural prolongation extended over this trough onto the Rockall Plateau to the west. If the argument is accepted, the UK could extend its claim by almost, a further 400 nm.<sup>558</sup>



<sup>556</sup> ibid at 36 para 40

<sup>557</sup> Higher n534 p191

<sup>558</sup> Emery n397 p294



In the Tunisia/Libya Case, the International Court of Justice held that the idea of natural prolongation would not necessarily be sufficient, or even appropriate in itself, to determine the precise extent of the rights of one State in relation to those of a neighbouring State.<sup>559</sup>

It should be noted that, in accordance with LOSC Article 121, islands in certain circumstances are entitled to generate all zones including an LOSC continental shelf. While restrictions are placed on what type of island may generate more than territorial waters no restrictions are placed on where the island must be situated.

Due to the lack of clarity regarding islands on oceanic ridges, it would appear that these islands, in terms of LOSC, can have natural prolongation seawards, regardless of whether they are situated on continental crust. Both Japan and New Zealand are islands on oceanic ridges and are considered to be able to generate LOSC continental shelf claims and Iceland is situated on a mid-oceanic ridge. It would be difficult to argue that these States are not entitled to LOSC continental shelf.

#### **OCEANIC PLATEAU**<sup>560</sup>

*A comparatively flat-topped elevation of the seabed which rises steeply from the ocean floor, and is of considerable extent across the summit.*

##### **Comment**

This submarine feature is contained in LOSC for consideration of the ratio of water to land when archipelagic baselines are being drawn.

#### **OCEANIC RIDGE**<sup>561</sup>

*A long elevation of the deep ocean floor with either irregular or smooth topography and steep sides.*

##### **Comment**

This is a feature which LOSC excludes from consideration when the LOSC continental shelf of a coastal State is considered. Most of the oceanic ridges are submarine ridges with occasional islands situated on them. It is not clear whether the above portions of these ridges are governed by the provisions of LOSC Article 76 (3). The question has been considered earlier in this Chapter in relation to natural prolongation.

#### **SEA-BED**<sup>562</sup>

*The top of the surface layer of sand, rock, mud or other material lying at the bottom of the sea and immediately above the subsoil.*

##### **Comment**

This term is used in LOSC to refer to the bottom of the sea beyond the continental rise, that is the deep ocean floor.<sup>563</sup>

#### **SEDIMENTARY ROCK**<sup>564</sup>

*Rock formed by the consolidation of sediment that has accumulated in layers.*<sup>565</sup>

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<sup>559</sup> Tunisia/ Libya Case n234

<sup>560</sup> LOSC Article: 47(7)

<sup>561</sup> LOSC Articles: 76(3) 7(6)

<sup>562</sup> LOSC Articles: 59, 76, 77, 162(2), 165(2), 159, 185, 186, 187, 188, 194, 287, 288, 289, 290(5), A3(21)(2), A6/14, A6/39, A6/25, A6/35

<sup>563</sup> LOSC Article 76

<sup>564</sup> LOSC Articles: 76(4)(a)(i)

### **Comment**

The distribution and extent of sedimentary rock is important in an LOSC continental shelf claim as the rise comprises sedimentary rock. Position, thickness and extent could be vital to substantiate a claim.

### **SPUR**<sup>566</sup>

*A subordinate elevation, ridge or rise projecting outward from a larger feature.*

### **Comment**

This is a submarine feature contained in LOSC as an exclusionary factor when LOSC continental shelf claims of a coastal State are considered.

### **SUBSOIL**<sup>567</sup>

*All naturally occurring matter lying beneath the seabed or deep ocean floor.*

### **Comment**

The subsoil of the seabed could contain resources in the form of residual deposits and minerals.<sup>568</sup>

### **SUBMARINE RIDGE**<sup>569</sup>

*An elongated elevation of the sea floor, with either irregular or relatively smooth topography and steep sides.*

### **Comment**

The outer limit of an LOSC continental shelf claim, along a submarine ridge, may not exceed 350 nm from the territorial sea baselines, unless the ridge is a natural component of the continental margin.

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<sup>565</sup> LOSC Article 76 (a) (i)

<sup>566</sup> LOSC Articles 76(6)

<sup>567</sup> LOSC Articles 59(3), 76, 77(4), 194(3)(c)

<sup>568</sup> Ross n137 p132

<sup>569</sup> LOSC Articles: 76(3), 76(6)

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## CHAPTER VII

## SURVEY

## INTRODUCTION

Surveying is the science necessary to determine and record the relationship between points or positions on any surface or in any medium in such a manner that will give true and reproducible values to these positions. This will allow for deductions and decisions to be made relating to these positions, the surfaces, and the media. Surveying and measuring are therefore essential to all sciences.

Features, such as land boundaries, land topography and coastline, bathymetry, configuration of the seabed, and in particular, the configuration and geomorphology of the continental shelf, structure of the seabed and subsoil, low-tide elevations and tidal observations have been considered previously. The positions of these features are essential in the consideration of many of the Articles of LOSC.

The following definitions of surveying identify with these requirements.

*Surveying is the art of making such measurements of the relative positions of points on the surface of the earth that, on drawing them down to scale, natural and artificial features may be exhibited in their correct horizontal and vertical relationship.*<sup>570</sup>

*The act or operation of making measurements for determining the relative position of points on, above or beneath the earth's surface.*<sup>571</sup>

*...surveying is the practice of positioning.*<sup>572</sup>

A concern of the surveyor, therefore, is the relationship of the positions of the many features referred to in LOSC to each other, the relevant datum and the accuracy of this positioning. While datum have been referred to in Chapter IV, the effect of variance in datum is very relevant to the accuracy of the surveys, the positioning and the delimitation and delineation based on them.

Not all information available for delimitation calculations is of recent origin. In the case of South Africa, some survey data, although considered to be very reliable, was surveyed more than a hundred years ago. A consideration of the development of survey procedures and their accuracy in relation to the requirements of the Articles of LOSC is therefore necessary. There is a vital difference in the delimiting of sea or ocean boundaries and land boundaries. The demarcation of a land boundary is a demarcation of sovereignty and any rights that another State may exercise in the territory would have to be by treaty.<sup>573</sup>

In the case of maritime boundaries, sovereignty, sovereignty with special interest rights to other States, specific rights, privileges and obligations are all possible in the various zones and in some instances different data, to the land boundary requirements, are required.

<sup>570</sup> D Clark *Plane and Geodetic Surveying* Vol 1 4th Ed (1953) p1

<sup>571</sup> IHO Dictionary n353 p236

<sup>572</sup> Vanicek n162 p19

<sup>573</sup> Akehurst n10 p16

*A further unique aspect of ocean boundary delimitation is brought out by the fact that most international land boundary adjudications establish boundaries that delimit territorial sovereignty for all purposes between competing states. Boundary delimitation of the continental shelf or other extended resource zones (such as the exclusive economic zone) determines Sovereign rights or jurisdiction for limited functional purposes.*<sup>574</sup>

## HYDROGRAPHIC SURVEYING

### HISTORICAL BACKGROUND

Surveying developed in earlier centuries from the need to produce maps and charts for navigation, both on land and sea. Surveying was also to demarcate State, local government, private property and other cadastral boundaries. Due to the fact that neither national nor international reference systems were available, both horizontal and vertical datum were adopted with local origins. Eventually, in some States, these regional datum were collated and, where possible, differences between the datum, resolved. In many States, however, this has not been possible. As a result there is data on large areas of the earth's surface that cannot readily be utilised for LOSC purposes without additional survey, collation or adjustment being undertaken.

*The early surveys were usually of a high standard considering the requirements, the equipment and the methods used at the time.*<sup>575</sup>

One of the criteria used to determine the maximum outer limits of the continental shelf is based on a formula related to sediment thickness in the area.<sup>576</sup> All other outer limits are based on distances from geographical features. In the case of the territorial seas, the contiguous zone and the exclusive economic zone these features are the low-water line (normal baseline), straight baselines or closing lines of bays.<sup>577</sup> In the case of the continental shelf, criteria are related to distances from the 2500 metre isobath and from the foot of the continental slope.<sup>578</sup> In both cases bathymetric survey data is necessary to determine these positions. Unless it is possible for specific surveys to be undertaken, existing bathymetric data will have to be used with caution.

Most existing bathymetric surveys were undertaken for hydrographic purposes, which is to ensure the safe passage of vessels. As a result the surveyors disregarded information that was not pertinent to maritime safety or navigation. Some of the bathymetric surveys that are still being used for the compilation of nautical charts and publications were done by leadline or single-beam echo soundings. In the preparation of nautical charts this practice has generally proved adequate, but should these charts then be utilised for delimitation purposes, errors of an unacceptable magnitude may be introduced.<sup>579</sup>

The methods of depth sounding used to accumulate the data that may still be in use in the production of nautical charts will be considered. These include leadline surveys, wire sounding, the development of echo sounders from single-beam to multi-beam, side-scan sonar and swath bathymetry.<sup>580</sup>

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<sup>574</sup> J I Charney "Ocean Boundaries between Nations : A Theory for Progress" AJIL Vol 78 No 3 (July 1984) p586

<sup>575</sup> K W Simpson & G M J Sweeney The Land Surveyor and the Law (1973) p16

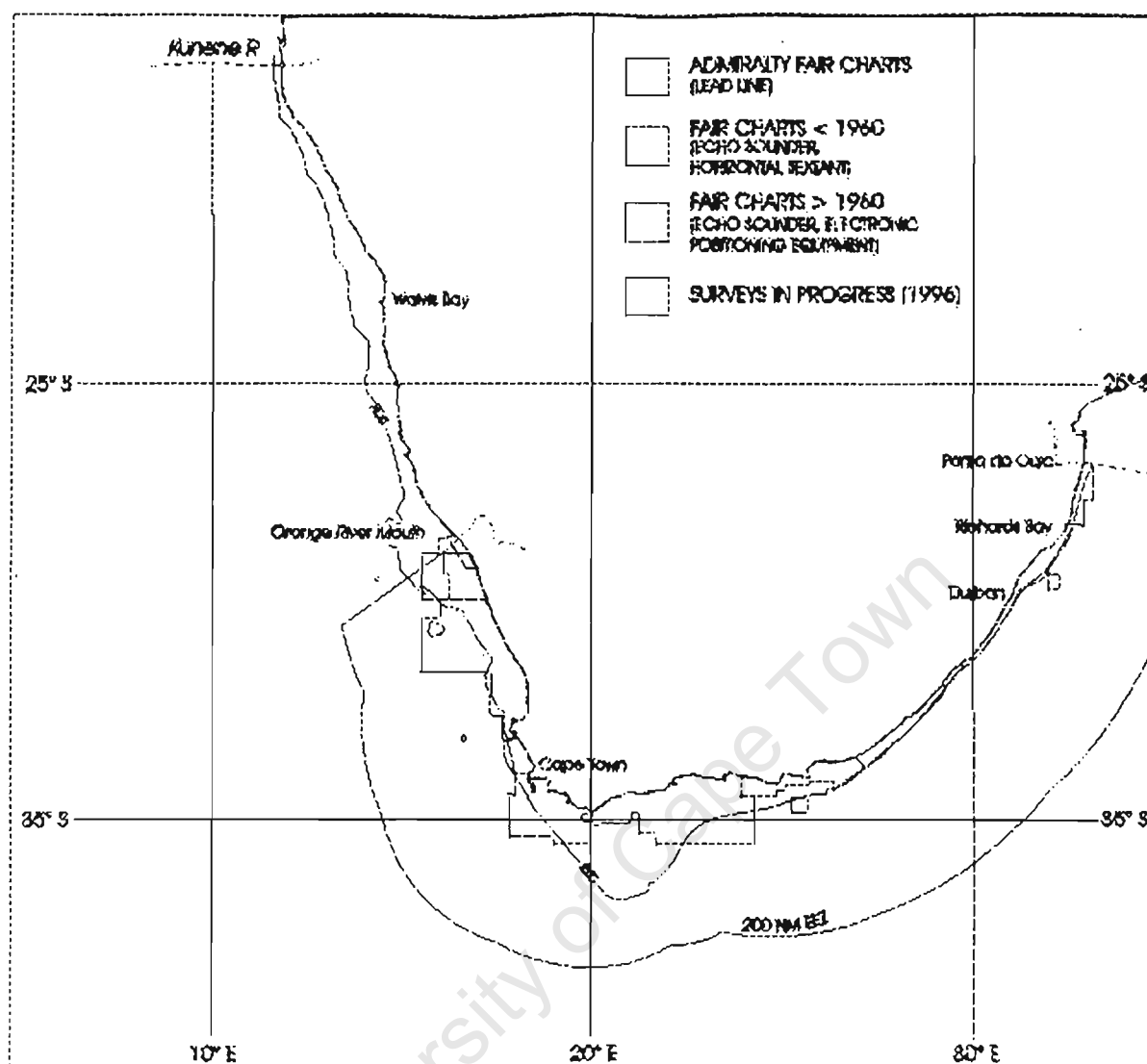
<sup>576</sup> LOSC Article 76(4)(i)

<sup>577</sup> LOSC Articles 5, 7 & 10

<sup>578</sup> LOSC Articles 76 4a(ii) and 5

<sup>579</sup> Carrera n197 p3:12

<sup>580</sup> British Admiralty Manual of Hydrographic Surveyors Vol 1 (1965) p2-3



**Figure 27 MAP SHOWING THE LIMITED AMOUNT OF HYDROGRAPHIC DATA NORMALLY AVAILABLE INSIDE 200 nm FROM THE COAST, FOR DELIMITATION USE.**

The methods of the horizontal positioning of the soundings, the coastlines and other features above and below the surface will also be considered and evaluated. They include astronomical, terrestrial and satellite-fixing by using sextant and horizontal sextant angles, Decca, Loran C and other radio-signal fixing methods and fixing from artificial satellite signals. Their accuracy will also be considered against the requirements of LOSC.

The methods of survey of source data still used in the preparation of nautical charts of the southern African coast as shown in Figure 27 indicate that much of the data has been acquired by obsolete methods. Data collected for the General Bathymetric Charts of the Oceans (GEBCO) and compiled, jointly, by the Inter-Governmental Oceanographic Commission (IOC) and the IHO is used where other data is not available but most of this data is from random observations and uncontrolled traverses. This data was never intended to be used for precise determinations.<sup>581</sup>

<sup>581</sup> US National Oceanic and Atmospheric Administration (NOAA) CD-ROM *Geodas* Vol 1 Preface (1994)

## VERTICAL MEASUREMENTS

### Leadline surveys

Leadline surveys were undertaken by lowering and measuring the length of a weighted line (leadline) to the seabed to determine the depth of water under the survey vessel. This could be done by hand or by mechanical devices depending on the depth of water. The line was usually marked in fathoms (approximately 3,3 metres) and except for these markings, this method was not much different from those in use for the previous 2000 years.<sup>582</sup> The position of the vessel had to be fixed in relation to the coast for the sounding to be of any value. This was usually done by fixing the vessel from terrestrial marks using horizontal sextant angles. The soundings were usually taken in lines at right angles to the coast and the vessel was expected to steer a straight course. As it was not possible to fix the position of the vessel at every sounding the position of the line was fixed periodically and the positions of intermediate soundings were interpolated.<sup>583</sup> Horizontal sextant angles that were observed for this purpose were transferred to a station pointer and the position plotted.



Figure 28      A TYPICAL SINGLE ECHO HYDROGRAPHIC SURVEY FAIRCHART  
(Showing the data confined to survey lines)

<sup>582</sup> N Bowditch American Practical Navigator (1958) p27

<sup>583</sup> BA Manual n570 p198

This graphical method of plotting required the angles to be set on a scale protractor on the station pointer. The station pointer had long arms radiating from the protractor, which were used to set the angles that had been observed. The station pointer was then manoeuvred until these passed through the points observed and then the centre of the protractor was at the position of the observer. While this method has proved more than adequate for survey purposes, problems could be experienced where some areas of delimitation require particularly accurate positioning.

When surveying, a survey vessel has to be underway to counter the effects of tidal stream, wind, swell, and current and so maintain a steady course. For verticality of the leadline to be obtained while underway, the leadline had to be dropped ahead of the position where the sounding was to be taken and the lead had to be on the bottom with the line taut at the time that the vessel passed over the position. The depth of water at that position was then read from markings on the line. The leadline had then to be recovered in time to be able to repeat the procedure at the next position. The maximum depth which this method was found to be effective was approximately 20 metres.

An indication of the concentration of soundings at these depths is that at a natural plot scale of 1/6 250 the sounding interval would be in the region of 15 metres, and at a scale of 1/50 000 it was approximately 45 metres. The speed of the vessel was determined by the scale of the survey plot to ensure that adequate coverage was achieved. Depths over 20 metres when measured from a moving vessel were not effective, as the required distances between the soundings were difficult for vessels to maintain. As the chances of encountering obstacles that were dangerous to the passage of vessels was less at these depths, random depths from stationary vessels were measured.<sup>584</sup>

These procedures were mechanised and the Somerville Sounding Gear, as an example, increased the optimum depth to 50 fathoms (165 metres).<sup>585</sup>

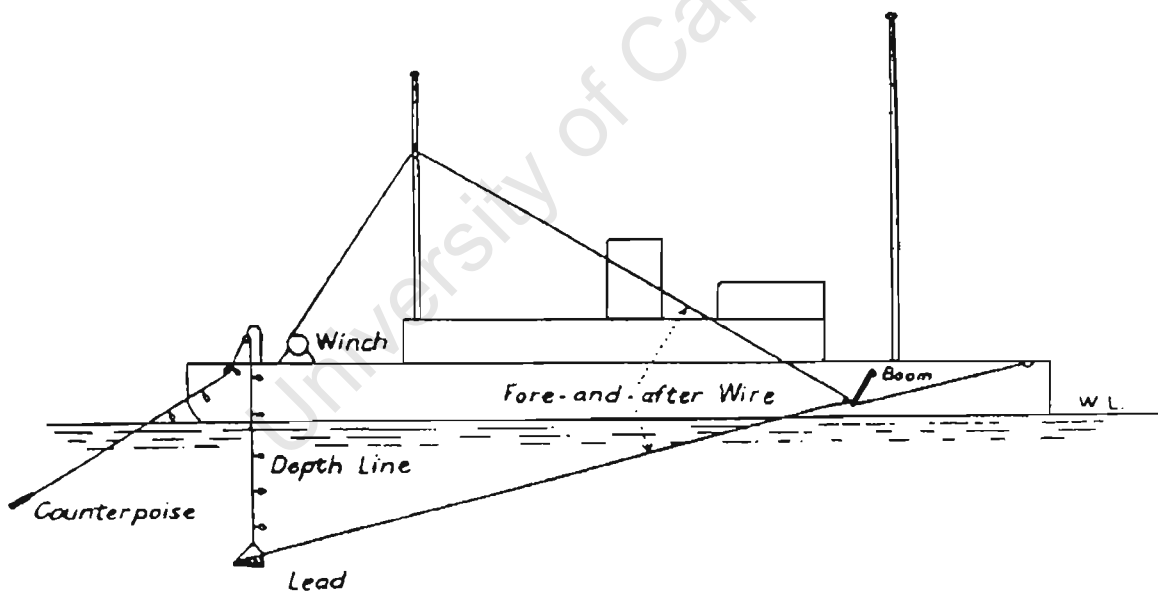


Figure 29

### SOMERVILLE SOUNDING SYSTEM

As these surveys were obviously concentrated in shallower water, and as the deeper soundings were relatively far apart, it is very unlikely that there would be sufficient data to define either the foot of the continental slope or the 2500 metre isobath. In large portions of the oceans and seas, particularly around Africa, these are the only surveys available.

<sup>584</sup> ibid

<sup>585</sup> ibid p213



## Deep-Ocean Soundings

Evidence exists of early efforts to measure the deeper ocean floor. In 1585, records indicate that a depth of 330 fathoms (1090 metres) had been measured. The reason for the measurements and the surveyor are unknown. Captain Phipps, a Norwegian, recorded a depth of 683 fathoms (2254 metres) in 1773.<sup>586</sup>

During the middle of the 19th Century Lt Matthew Fontaine Maury of the United States Navy, who is regarded as the pioneer of deep ocean bathymetry, made his deep sea soundings by;

*securing a cannon shot to a ball of strong twine. The heavy weight caused the twine to run out rapidly, and when the bottom was reached, the twine was cut and the depth deduced from the amount remaining on the ball.*<sup>587</sup>

## Echo-Sounder

In the 1920s single-beam echo-sounders were developed and introduced into bathymetric surveying. These devices were based on the principle that sound travels through the water at a nearly uniform rate. By knowing the speed of the sound wave in water and by knowing also the elapsed time from the emission of the signal to its reflection on the bottom and then to the recorder back at the vessel, the depth could be calculated and automatically recorded.<sup>588</sup>

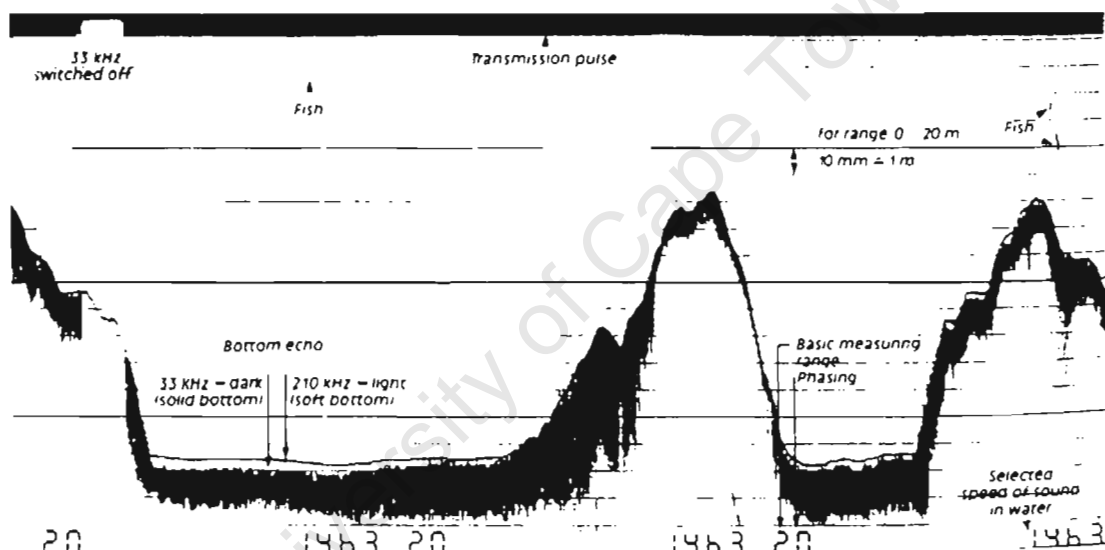


Figure 30 AN EXAMPLE OF AN ECHO-SOUNDER TRACE  
(Showing the seafloor with an exaggerated vertical scale)

The advantage of this system was that a vessel could now steam up and down predetermined lines, and providing the horizontal position of the ship was constantly fixed, a record of the depths below the vessel would be recorded without laborious on-deck activity. Technical developments in these systems increased the depths to which soundings could be taken and depths below 500 fathoms (1650 metres) were obtainable.<sup>589</sup> This did not eliminate the problem that all the soundings were confined to lines and that there were gaps between the lines where no depths were recorded. While the data could be corrected for the state of the tide other natural factors such as swell and the roll, pitch and heave of the vessel were difficult to measure and to correct for.

<sup>586</sup> Bowditch n572 p27

<sup>587</sup> ibid

<sup>588</sup> ibid p28

<sup>589</sup> ibid

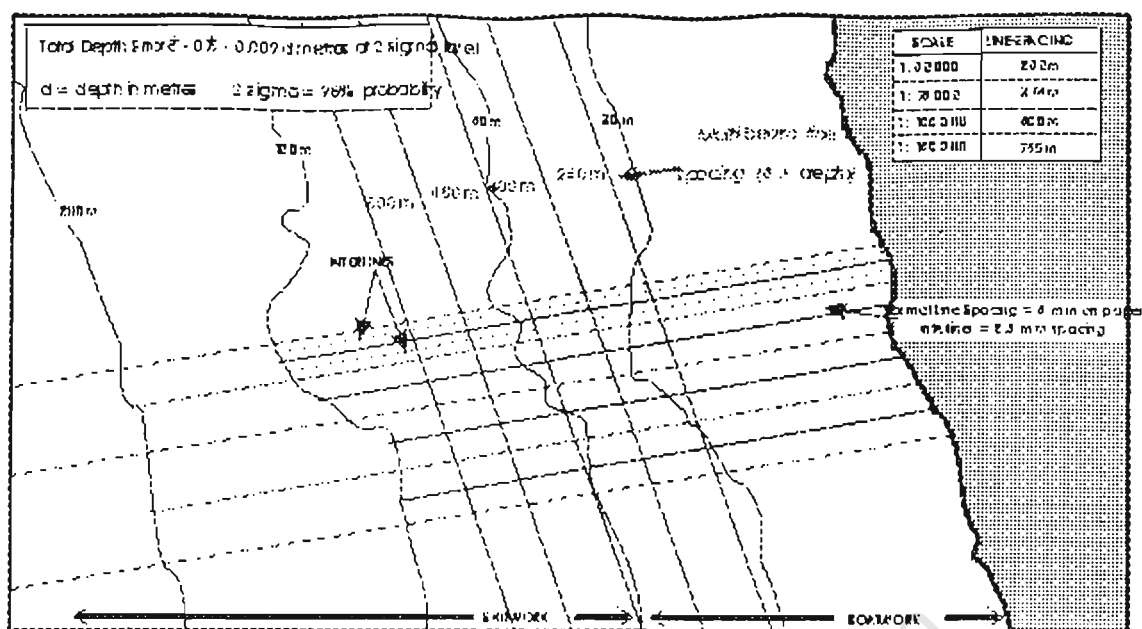


Figure 31 TYPICAL LINES OF SURVEY USED DURING HYDROGRAPHIC SURVEYS FOR THE PREPARATION OF NAUTICAL CHARTS

The speed of the sound beam was usually of the order of 1500 metres per second. It also varied according to the temperature in the various layers of seawater at different depths. While this is important for very precise surveys, it should not materially affect the determination of the position of either the 2500 metre isobath or of the foot of the continental slope.<sup>590</sup>

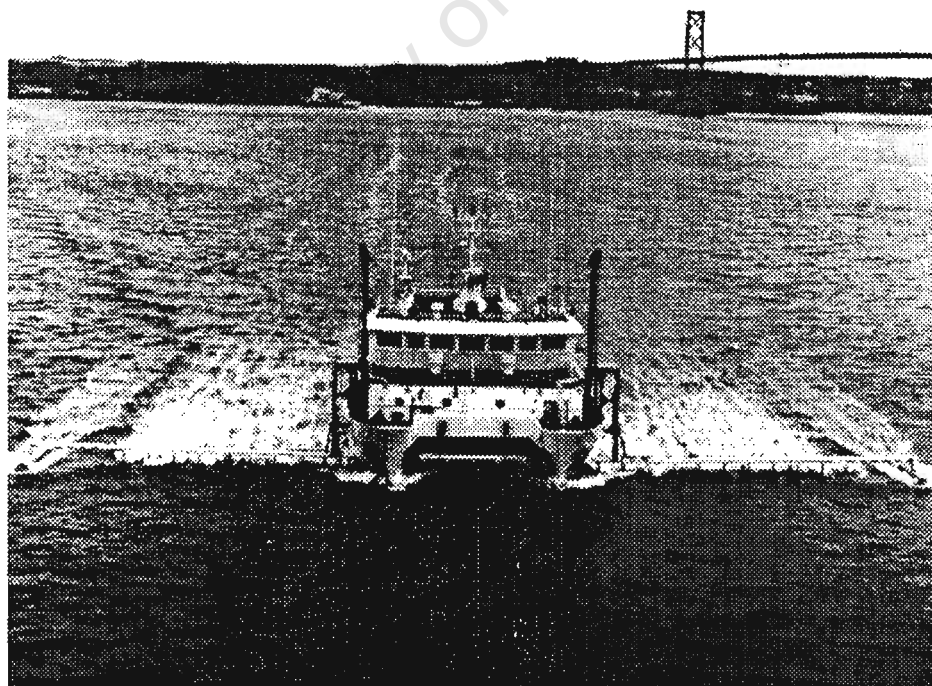


Figure 32 ECHO-SOUNDER TRANSDUCER ARRAYS SECURED TO BOOMS PROJECTING FROM THE SIDE OF THE VESSEL TO INCREASE SURVEY COVERAGE OF THE SEABED

<sup>590</sup> Bowditch n194 p134

Errors were also encountered as the echo-sounders could penetrate substantial thickness of soft mud or ooze on the sea bed to record the depth of harder bedrock beneath instead of the surface of the seabed. This was minimised by technical developments and by the operators, as they became more experienced.

For close inshore soundings, the horizontal positions of the soundings were initially achieved by erecting and positioning onshore beacons large enough to be visible from the vessel. These beacons would be spaced along the coast in positions with suitable horizontal angles between the observer and two beacons being observed for fixing the vessel. These angles would then be used to position the vessel, by station pointer, as it approached the coast from seaward. If the depth of water beyond the seaward end of the survey lines allowed, danbuoys would similarly be laid and fixed seaward of the survey area and used by the vessel on its seaward run. If this were not possible the terrestrial beacons would be observed when travelling in both directions.

Sounding lines beyond the visibility of the coast would have had to be positioned by normal navigation methods including astronomical fixes and dead-reckoning calculations. These are based on the vessel's course and speed over the ground between fixes.<sup>591</sup> Astronomical fixes are obtained by reducing a series of observations to the sun in daylight and to stars at twilight. As all surveys were conducted in daylight, the control of the surveys was restricted to a series of observations of the sun.

While sights could be taken at anytime, for ease of sight-reduction non-sights were mostly observed. Morning and evening star-sets were also observed. These were observed at a time when both they and the horizon were visible. The horizon was necessary to be able to observe the height of a star above the horizontal. The best accuracy that can be expected from these observations is between 1-1.5nm.

Modern single-echo sounder systems have improved to the point where the accuracy is more than adequate for both survey and navigation purposes, but they still have the problem that the coverage is only that portion of the seabed immediately below the transducer.

### **Side Scan Sonar**

As it became essential to widen the width of the echo survey path, dedicated systems evolved. Many systems were developed which allowed for a towed metal 'fish' to obtain data from the seabed by recording sonar transmissions from strip transducers fitted along the length of each side of the fish. The transducers on this strip were placed at half-wave frequency to give an enhanced transmission envelope so that, if the height of the fish above the seabed were correctly regulated, the surveyed path would cover the optimum area either side of and up to the central course line.<sup>592</sup>

### **Geological Long Range Inclined ASDIC (GLORIA)**

In 1969 the United Kingdom's Institute for Oceanographic Sciences, now the Southampton Oceanographic Centre, developed a deep-ocean side-scan-sonar system to assist with the identification of the following;

- a) locations of strategic and other minerals- polymetallic nodules and crusts;
- b) locations of hydrocarbons- oil and gas;
- c) sites for 'farming' of shellfish and other marine life;
- d) sites for harnessing ocean thermal energy;
- e) optimum routes for cable- and pipe-laying;

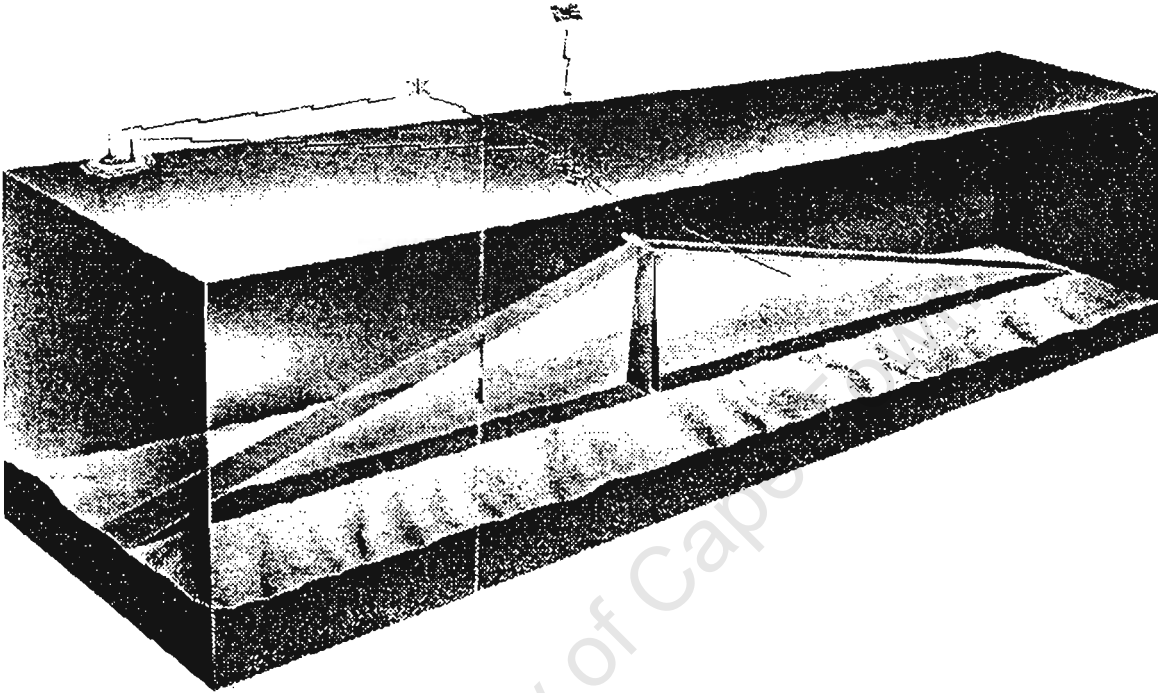
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<sup>591</sup> *ibid*

<sup>592</sup> A E Ingham Hydrography for the Surveyor and Engineer 2nd Ed (1984) p84-85

- f) sites for disposal of toxic and other waste;
- g) location of earthquake and volcanic zones;
- h) exclusive economic zone and continental shelf territories in terms of international law.<sup>593</sup>

In 1984, the United States Geological Survey decided to map their entire exclusive economic zone using the GLORIA system. This was essentially for reconnaissance purposes and was an effort to gain information about the configuration of the margin and deep-sea-bed out to 200 nm.



**Figure 33 THE WIDE COVERAGE OF THE GLORIA MULTI-BEAM SYSTEM**  
(Coverage could be as much as 60 nm)

Horizontal control was by the use of Loran C, Transit Satellite and Global Positioning Systems (GPS). GPS was in its elementary stages, when available. These systems will be considered later in this Chapter. The results of the GLORIA surveys were to be used with multibeam surveys being undertaken at the same time in the same area by the US National Oceanic and Atmospheric Administration (NOAA), now known as National Imagery and Mapping Agency (NIMA). Over a period of 4 years, 1.5 million square miles were mapped. Many previously unknown volcanoes were located and the evidence of the fracture zones, facilitated the development of sea-bed-mapping of the zone. Some of these volcanoes had well-formed craters and it is anticipated that they will contain cobalt-enriched manganese oxide.<sup>594</sup>

*Without exception, the mapping results in each area surveyed have revealed new and exciting information about the exclusive economic zone seabed.*<sup>595</sup>

As this system is, essentially a deep-water survey system, its accuracy makes it, at this stage unsuitable for accurate surveying purposes. It is unlikely that these data could be used for final boundary or maritime zone delimitation.

<sup>593</sup> Marine Underwater Systems GLORIA Deep Ocean Surveys (1987) p3

<sup>594</sup> AS Laughton "The First Decade of GLORIA" IHR Monaco LX (1)(January 1983) p42, BA McGregor & GW Hill "Seafloor Image Maps of the US Exclusive Economic Zone" The Hydrographic Journal No 53 (July 1989) p9-10

<sup>595</sup> *ibid* p13

## Accuracy

The system is capable of mapping swathes, 60 km wide, of the deep sea-bed at vessel speeds of 8 knots. It is possible therefore to map 20 000 square kilometres per working day. The great benefit of a system such as this is that it enables vast areas of the seabed to be mapped, regardless of depth, and identifies the areas that should be surveyed later in greater detail.<sup>596</sup>

## Precision Depth Recorders

In the 1950s, further improvements to transducers, especially in the accuracy of the timing of transmissions, led to the development of precision depth sounders and recorders (PDR). PDRs were able to establish the configuration of the seabed but, as the beam width was from 30-60 degrees, only gross relief could be delineated. Accurate narrow-beam echo-sounders, with six beams 2-3 degrees wide, were developed and compensated for the roll and pitch of the vessel. This type of echo-sounder should not be confused with the wide-beam single-beam echo-sounder mentioned earlier.<sup>597</sup>

Although these echo-sounders were able to record relief from metres to kilometres, the original problem of the single-beam echo sounders, that the soundings were confined to lines, remained. For economic reasons, the lines were spaced up to kilometres apart and the record of the sea-bed could only be considered as sampling. Contouring is difficult and less accurate where the data is concentrated in the lines of soundings with no data between the lines.

An attempt to obviate this narrow path was to mount a series of these transducers on long booms extended from the side of the vessel, to arrange a series of towed vessels fitted with the multi-beam transducers that travelled astern, but on either side of the main vessel, or for a series of small launches to be fitted with transducers and navigated from, and on either side of, the survey vessel.<sup>598</sup>

## Multi Beam Swathe Bathymetry

The most recent development has been the combining of a series of these transducers into one unit, arranged at regular but different angles. In the 1970s the first functional system was developed by the General Instrument Corporation (GIC) and was known as the Sonar Array Sounding System (SASS). This was not made commercially available. Subsequent advances in real-time computing and data management and storage allowed GIC to produce two commercial systems, 'Seabeam' for deep water and 'Hydrochart' for shallow-water operations. The Seabeam system has a swath width of approximately 3/4 of the water depth and as a result it is only marginally useful in shallow water. The Hydrochart II system was designed to fill this need.

During the 1980s the following systems were produced; Hydrosweep and Bottomchart by Krupp Atlas Elektronik and Honeywell Elac respectively (West Germany), Echos XD by Hollming Electronics Ltd (Finland), EM100 by Simrad and the towed multibeam system, Benigraph, by Bentech (Norway) and the Multibeam Sonar System, MBSS, was developed by Japan Radio Company (Japan).<sup>599</sup>

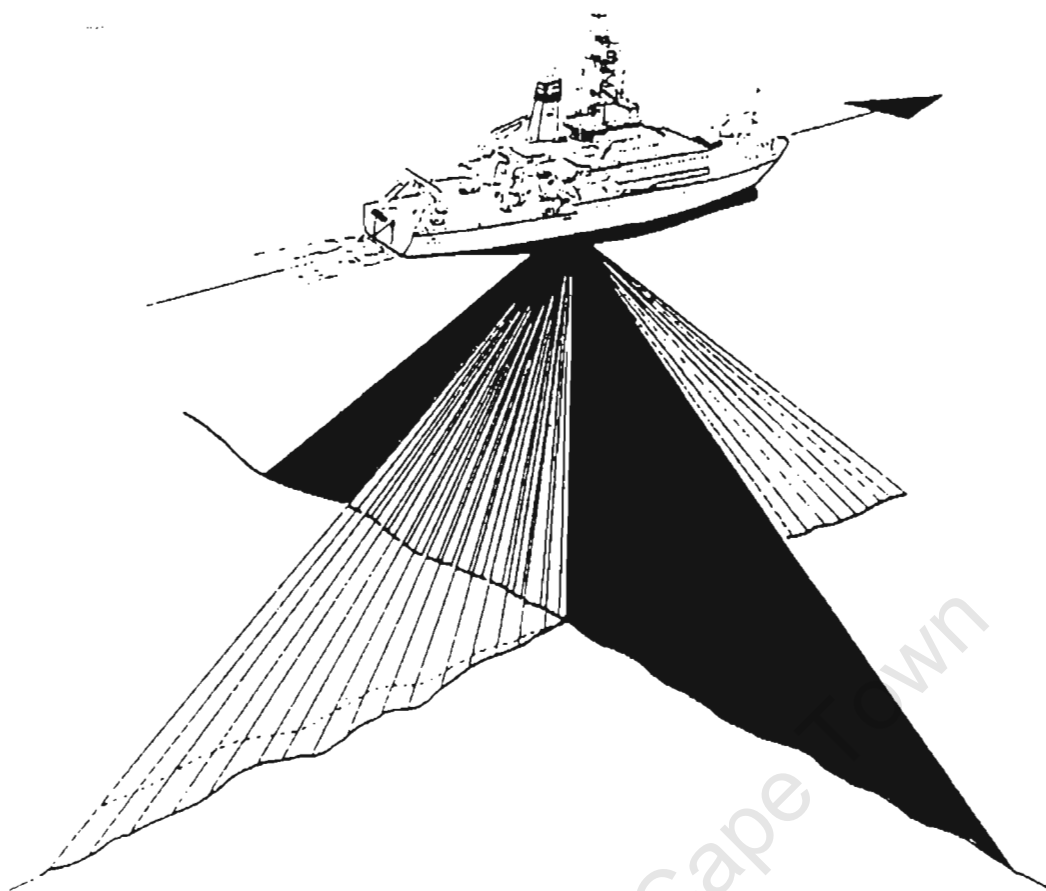
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<sup>596</sup> ibid p4

<sup>597</sup> C de Moustier "State of the Art in Swath Bathymetric Survey Systems" *IHR LXV2* (July 1988) p40

<sup>598</sup> R Burke et al "2 088 000 Depth Measurements per hour : A Formidable Data Processing Challenge for any Hydrographer" *Canadian Hydrographic Conference Proceedings* (1987) p2, R Burke, S Forbes & K White "Processing 'Large' Data Sets from 100% Bottom Coverage 'Shallow' Water Sweep Surveys" *IHR Monaco LXV* (2)(July 1988)

<sup>599</sup> de Moustier n587 p27



**Figure 34 THE EXPECTED COVERAGE ATTAINABLE FROM A MULTI-BEAM SYSTEM**

The multi-beam echo-sounders usually consist of hull-mounted transducer arrays, with appropriate transmission timers, generators and beam-configuring networks. There is also an echo processor digitising the echoes from the various beams corrected for the roll, pitch and heave of the vessel and refraction. Most of these processors are capable of producing underway plots of the seabed with contours to metre accuracy.<sup>600</sup>

*Taking advantage of the interchangeability of the transmit and receive functions between the two arrays, the system enters a 'calibration' mode by switching from the standard athwartships receive pattern to a fore-aft receive pattern every 25 pings. By comparing the depth measurements made on the centre beam in the athwartships mode over a number of successive pings with those obtained on the 59 beams in the fore-aft mode, the system is able to perform an approximate ray-bending inversion and to determine the mean sound speed through the water column which is then used for subsequent refraction corrections.<sup>601</sup>*

Multi-beam echo-sounders, such as the Medium-Depth (MD) Hydrosweep System, have made it possible to measure depths from 10 metres to 1000 metres by the use of up to 60 mutually independent beams, arranged in such a manner as to measure not only the depth under the vessel, but in a path on either side of its track. This breadth can be from eight times the depth of water (1600 metres) at about 200 metres to four times the depth (2000 metres) at 500 metres and equal to the depth (800-1000 metres) at depths of between 800 to 1000 metres.

<sup>600</sup> ibid p28

<sup>601</sup> ibid p40

A Deep-Water Hydrosweep (DS) system is capable of measuring swathes at most depths on the deep-ocean floor. The quality of the results of the MD system will depend on the following;

- a) the graininess and roughness of the bottom;
- b) the slanting sounding angle (angle between a beam and the bottom);
- c) the gradient of the bottom;
- d) the density of the bottom;
- e) the choice of sounding frequency.<sup>602</sup>

Applications of phase-measuring interferometry have also been developed at the same time as swath systems, but they proved to be too expensive at that stage. During the 1980s collaborative efforts were made to include this technology into the 'Seamarc' side-sonar system. This adapted system, known as 'Seamarc II', combines high-resolution side-scan imagery of the seafloor with swath bathymetry capabilities. It was the first system of this nature and has been followed by 'Seamarc S' for mid- and shallow-water areas.<sup>603</sup>

A major disadvantage of both side-scan-sonar and swath systems is the high density of data collected. While this is a capability that should be retained, it creates processing and storage problems at this stage of developments.<sup>604</sup>

### Large-Scale Charts

Two terms that are used extensively throughout LOSC are 'large-scale charts officially recognised by the coastal State.' and 'low water line along the coast'.

In the majority of cases, the only large-scale charts available are those of ports or harbours and their approaches, which have been prepared for navigational purposes. These scales are usually between 1/5000 and 1/50 000, of which only the lower range can be considered large scale. Most of the rest of coastline will have been charted at scales of 1/150 000 or less.<sup>605</sup>

The surveys from which the charts are prepared are usually at twice the scale of the chart, i.e. a 1:150 000 scale chart is compiled from surveys done at a scale of 1:75 000. Charts with scales smaller than 1:20 000 cannot be regarded as large-scale charts, regardless of the scale of the surveys. Special charts will, in most cases, be required for delimitation purposes.<sup>606</sup>

The second factor, that the baseline is the low-water line, creates further problems in the use of these charts, when surveyed for hydrographic purposes. Unless the beach gradient is sufficiently low to create substantial lateral movement with the fall of the tide, the coastline is accepted as being the position of high water springs. Evidence of this, such as flotsam, can usually be detected on the coast.

The lowest tide that is anticipated in an area in an 18,61 year full tidal cycle is calculated as the lowest astronomical tide (LAT). The duration that any tide is at its lowest level in its daily tidal cycle is only a few minutes. Even allowing for the fact that there is little height change just before and just after a change of tide, the maximum time that would be available to survey the position of the low-water would be approximately a half hour. It follows therefore, that if a State is basing its low

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<sup>602</sup> ibid p32-35

<sup>603</sup> de Moustier n587 p27

<sup>604</sup> D R Herlihy et al "Swath Mapping Data Management within the NOAA" IHR Monaco LXV (2) (July 1988) p56-67

<sup>605</sup> Bowditch n572 p104

<sup>606</sup> ibid p104-5

water line on LAT it will have a maximum of half an hour every 18,61 years in which to survey its low-water-line. This is also providing that LAT occurs in daylight and that the weather conditions are favourable.<sup>607</sup> This is hardly a practical application, but during the course of each monthly tidal cycle throughout the 18,61 years, the horizontal position to which the lowest tide may vertically recede may not vary significantly from that reached at LAT, providing that the beach gradient is relatively steep.

Other low waters during the tidal month may also be usable, but even with these concessions there is very little time to survey a very inconveniently adopted boundary.

It would appear, therefore, that, if a delimitation of a lateral boundary between States depends on the determination of normal baselines, a new survey of the low-water-line on either side of this boundary will be required. During 1978, the maritime boundary between the South Africa and Namibia was surveyed by aerial-photogrammetry. The landward end of the boundary is at the Orange River mouth and the mean low- water line at that time was adopted. The aerial-photography was especially flown. It was further decided that a tidal-height difference of 0,1 metres vertically either side of mean low-water would not create significant lateral differences.

*there is no doubt that aerial photography provides the most rapid and practical means of charting the line over long distances. Nearly 80 km of it had to be surveyed for the project described... If it ever becomes necessary to survey the whole of the Republic's*

*low-water line of nearly 3000 km it will cost millions...The photography for this project was taken at mean low-water level....*

*It is impossible, of course, to photograph the whole 80 km of coastline at the precise instant when the water level reaches mean low-water. It takes a while to fly the strip during which time the water level changes. It was, therefore, decided that a tolerance of 0,1 m in the water level on either side of the value of mean low-water would be acceptable. This gave the pilot 40 minutes in which to complete the photographic mission, a period which turned out to be long enough for the purpose.*<sup>608</sup>

The major continental shelf cases adjudicated by the International Court of Justice and by arbitration tribunals since 1960 are the North Sea Continental Shelf Cases, the Anglo French Continental Shelf Case,<sup>609</sup> the Tunisian/Libyan Continental Shelf Case,<sup>610</sup> the Libya/Malta Continental Shelf Case, (1985)<sup>611</sup> and Canada/France (St Pierre et Miquelon) Arbitration 1992.<sup>612</sup> The Iceland/Norway Agreement (Jan Mayen)1993, while not a case, is a major reference when considering LOSC continental shelf delimitation.<sup>613</sup>

In the Gulf of Maine Case, the Court defined a single maritime boundary, which included the continental shelf.<sup>614</sup>

In the Libya/Malta Case, Libya argued that a natural boundary, in the form of discontinuity in the seabed, should form the boundary between the two States. The Court however dismissed this argument

<sup>607</sup> ibid p150, US (NOAA) The Strategic Role of Perigean Spring Tides in Nautical History and North American Coastal Flooding, 1635-1976 (1976) p218, BA n196 p38

<sup>608</sup> E Fitchen "The Survey of a Median Line Sea Boundary" Proceedings of the Conference of South African Surveyors (1978) p5/6

<sup>609</sup> Anglo/French Continental Shelf Arbitration n167

<sup>610</sup> Tunisia/ Libya n234

<sup>611</sup> Libya/Malta n238

<sup>612</sup> St Pierre and Miquelon (Canada/France) (1985) ICJ Rep 13, 24 ILM 1189

<sup>613</sup> Jan Mayen n543

<sup>614</sup> Gulf of Maine Case n240



and favoured the argument of Malta that 'distance' as embodied in LOSC should be used as the criteria

*...since the development of the law enables a State to claim that the continental shelf, appertaining to it, extends up to as far as 200 miles from its coast, wherever the geological characteristics of the corresponding sea-bed and subsoil, there is no reason to ascribe any role to geological or geophysical factors within that distance either in verifying the legal title of the States concerned or in proceeding to a delimitation as between their claims.*<sup>615</sup>

The French *Collectivité Territoriale* of St Pierre and Miquelon, lies close off the coast of Newfoundland. The distance between Newfoundland and the islands varies between 10 nm and 30 nm and is regarded as valuable fishing grounds. In 1972, an equidistant line was agreed to between the mainland and the islands. The seaward boundary, encompassing possible economic zone and continental shelf claims, became the subject of arbitration.<sup>616</sup> An *ad hoc* Arbitration Tribunal held that the boundary should approximate an equidistant line. There is a multitude of possible basepoints but it was held that the boundary should consist of only nine turning-points. The southern and western boundaries between the islands and Canada must still be resolved.

A Conciliation Commission, as a third party dispute-settlement procedure, rendered a report and recommendations to the Governments of Iceland and Norway in regard to the delimitation of the continental shelf around Jan Mayen Island and the fishing rights between this island and Iceland. The Commission concluded that 'natural prolongation' was not a suitable criterion to be applied. Although Jan Mayen is only inhabited by the staff of a meteorological station, in the agreement, between Iceland and Norway, that followed the Report of the Commission, it was acknowledged that Jan Mayen was entitled to generate and claim both continental shelf and an exclusive economic zone but these claims would encroach within 200 nm of Iceland. It was agreed that the boundary should coincide with Iceland's 200nm limit.<sup>617</sup>

While there are factors particular to each case essential requirements, common to all cases, include accurate mapping of the sea bed and undersea features.

One of the criteria establishing a maximum for a continental shelf claim is the requirement of Article 76 (5) for the outer limit to be less than 100 nm from the 2500 metre isobath. A secondary requirement is that the outer limit must be less than 350 nm from the baselines from which the territorial sea is measured. A coastal State may use whichever is the greater of these two criteria. The 2500 metre isobath is, in most cases, found near the foot of the continental slope. The shelf break is usually at about a depth of 200 metres and the deep sea-bed usually commences well below 3000 metres.

### **General Bathymetric Chart of the Oceans**

Contours or depths in the region of 2500 metres are usually beyond the interest of hydrographic surveyors. The GEBCO data are available from the GEBCO programme, which is by the IOC and the IHO to produce the General Bathymetric Chart of the Oceans.<sup>618</sup>

The collection of sounding data of the deep ocean floor is used for;

- a) specific GEBCO programmes;
- b) data gathered during the course of other research programs as additional information;
- c) data gathered by vessels in transit.<sup>619</sup>

<sup>615</sup> *Libya/Malta* n238 para 40, *Highet* n534 p177

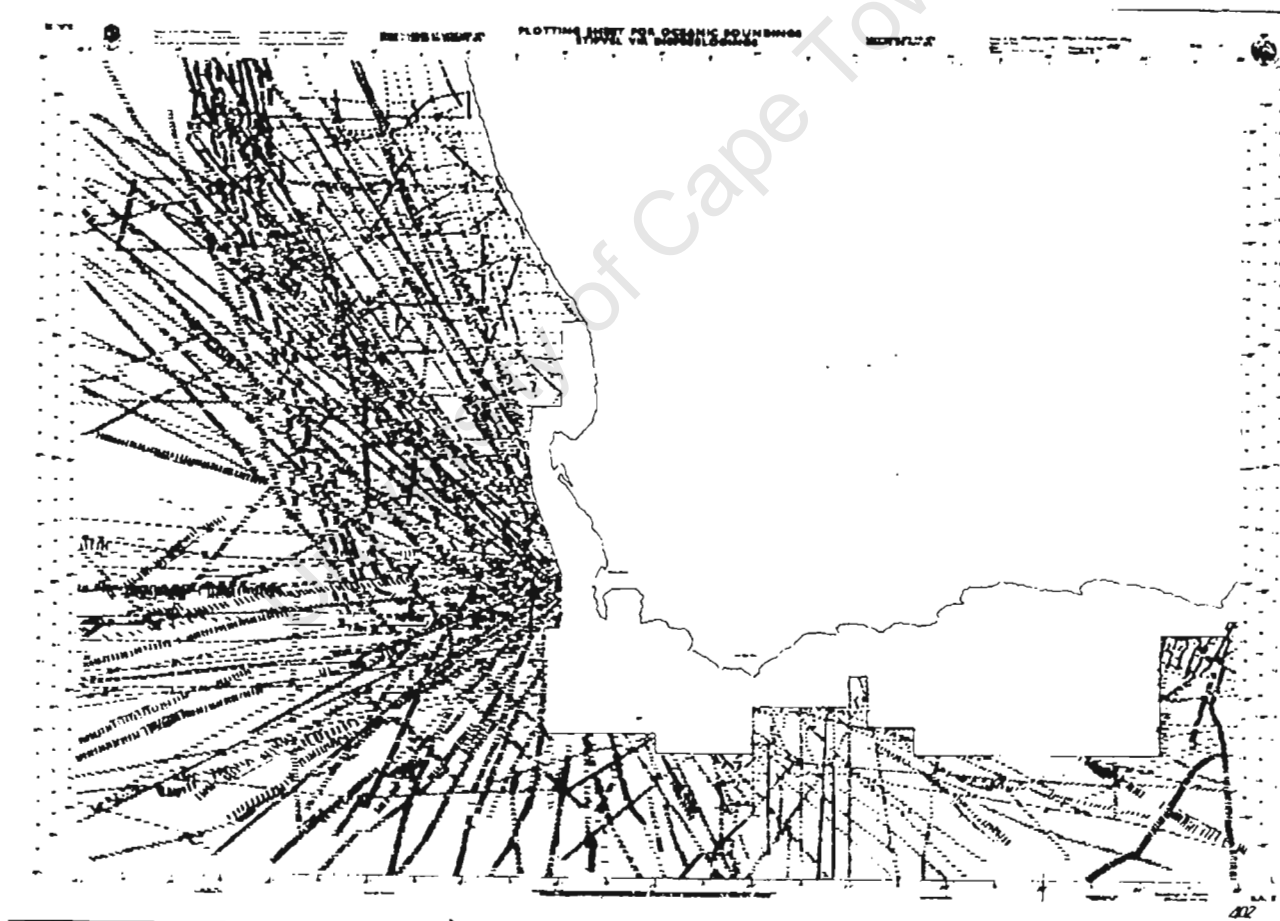
<sup>616</sup> *Bowett* n333 p147

<sup>617</sup> *Jan Mayen* n543 p42, *Bowett* n119 p146

<sup>618</sup> US (NOAA) *Geodas* n571

As can be seen, the standard of the collection of GEBCO data can vary from dedicated surveys to passage-of-convenience recordings. These data are assessed and made available on plotting sheets at a scale 1:1 000 000.<sup>620</sup> In 1994 the data became available in digital form as the GEBCO Digital Atlas. Many of the vessels submitting data to the GEBCO data bank in Boulder, Colorado, USA follow regular routes and many of the soundings occur in the same areas of the deep ocean or along the same track. The GEBCO data will have to be carefully assessed to establish their accuracy. By using acceptable and available data, the areas where it will be necessary to conduct specific bathymetric surveys and to compile profiles to position the 2500 metre isobath or the foot of the continental slope can be identified.

GEBCO data are unique in that it can be recorded by vessels other than research or survey vessels. While an accuracy probability is given to each data set, in many instances these data could be the only data ever recorded in an area. Most of the data are, however, obtained by surveys, usually as part of deep-ocean research. The vessels may be engaged in other research, but as it is now relatively simple to record these data, these vessels record as much bathymetric data as possible. If it is a specifically dedicated cruise to obtain GEBCO data, the accuracy of the data gathered is evaluated against standard criteria. A large volume of data is available, or is collected, but due to the constraints of the scale of the plotting sheets, 1:1 000 000, only a very small percentage can be plotted and used.



**Figure 35 RANDOM BATHYMETRIC OBSERVATIONS COLLECTED BY RESEARCH VESSELS WHILE IN PASSAGE**  
(These observations are used mainly in the GEBCO Programme)

<sup>619</sup> IHO/IOC Guidelines for the General Bathymetric Chart of the Oceans (2nd Ed) (1991) p1.2

<sup>620</sup> *ibid* p1-21

Due to the fact that Article 76 LOSC provides for claims by a coastal State to continental shelf, which may include areas that are geologically considered to be deep-ocean floor, bathymetric and seismic surveys may have to be conducted to depths well below 3000 metres.

Seismic surveys are expensive in comparison to hydrographic surveys, so the 2500 metre isobath and the configuration of the seabed in the region of the foot of the slope should be accurately surveyed before an assessment can be made as to the need for seismic surveys to be undertaken.

The Joint IOC/IHO Guiding Committee for GEBCO has, amongst other responsibilities, the following;

*Advise the International Hydrographic Organisation (in its capacity as the World Data Centre for Bathymetry) on matters connected with the collection and exchange of high quality bathymetric data, including both the compilation and updating of the 1:1 000000 plotting sheets and the development of automatic data generating, archiving and retrieval, soliciting the advice and assistance of the IOC Working Committee on International Oceanographic Data Exchange (IODE), as necessary.*<sup>621</sup>

This programme is well administered and although the data that are held in the data bank are sparse, it can nevertheless assist with the provisional positioning of both the 2500 metre isobath and the foot of the continental slope. There is no doubt, however, that specific survey programmes will have to be undertaken to satisfy international requirements for these determinations.

### **Foot of the Continental Slope**

Vanicek and Ou<sup>622</sup> feel that it should be possible to trace the foot of the slope automatically from bathymetric data available. The alternative that they propose to the standard of choosing a foot of slope from a profile is to use an algorithm developed by them. This is based on a three-dimensional surface of maximum curvature derived from the available bathymetry. On this a foot-line corresponds to a ridge. As the model has been analytically generated it is possible to identify and compute the foot of the slope analytically. It is essentially a process of identifying ridges with the foot-line being one of these ridges. The ridge points used for this purpose are determined from an analysis of a matrix of the points that make up the surface of the model being considered. As other ridges generated by local features must be eliminated, the maximum curvature surface and the bathymetric surface are compared. This also assists in identifying the correct position from a number of positions in the same area of the slope. An examination of the ridge-lines will indicate the longest line which will be the foot-line.

A number of uncertainties have to be eliminated. One is errors in bathymetry and the other is uncertainty in the region of the actual change of gradient from the continental slope to the continental rise or deep-ocean floor. It is possible to have a change in this area which is gradual and that it is difficult for any method to be able to identify the foot precisely. The errors that are possible in horizontal positioning are considered later in this Chapter. It is possible therefore by the use of this method, to identify the foot of the slope automatically over a large area or to confirm the foot of the slope adopted by other methods.

The surveys undertaken to establish the 2500 metre isobath and the foot of the continental slope would most likely be well offshore and fixing the horizontal position of the depth-recorder position would have been undertaken by currently available standard navigational methods. These could have included systems such as Omega, DECCA Navigator System, Loran C and the Global Positioning System (GPS). Each of these, while adequate for navigational purposes, have limitations when used

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<sup>621</sup> ibid 1-5(5)

<sup>622</sup> Z Ou & P Vanicek "Automatic Tracing of the Foot of the Continental Slope" University of New Brunswick Proceedings of the 2<sup>nd</sup> GALOS Conference(1996)

for precise survey purposes. A comparison of the accuracy of these systems will be made in later Chapters

## **HORIZONTAL SURVEY SYSTEMS**

### **Omega**

This is a very low-frequency world-wide radio navigation network system, which operates with a frequency band of about 10 kHz.<sup>623</sup> The initial intention of the service was to be world-wide, continuous, and all-weather but as it is unlikely that systems of this nature can be all-weather, early expectations were not realised. It is the oldest system of its kind. There are eight stations that transmit on a frequency on a time-sharing basis for about 1 sec each. A station identification is made every ten seconds. The transmissions are cesium-clock controlled. The main instrumentation is at the transmitting stations, which has three components, timing and control, transmitting, and antennas. The receivers comprise radio-frequency monitoring, programmers, computer and power supplies.

### **Differential Omega**

Omega is capable of being structured in a differential format, as are the other systems. Differential control of a positioning system is achieved by comparing the positions determined by the system with already adopted values. After evaluation and adjustment, the corrections can be applied to the other positions in the area fixed by the system.<sup>624</sup> It is possible that, due to the low accuracy of the system, it will be phased out before the year 2000.

### **DECCA Navigator System**

The DECCA system was introduced in South Africa and Namibia during the later part of the 1960s. The original requirement was a navigational requirement for maritime reconnaissance by aircraft. At that time it was a system in world-wide use and it has been in service in this area since it was initially installed over 30 years ago. The system very soon became popular with non-military users who eventually became the prime users. This system was used extensively by the hydrographic vessels engaged in surveys off the coast of these two States and the accuracy of their surveys is directly related to the accuracy of the system.

The DECCA system comprises shore-based stations transmitting radio-position-line patterns, which can be detected by a shipboard receiver up to a distance of approximately 480 km. The range varies between day and night recordings and the maximum night-ranges are usually less than those observed during daylight. There are usually four stations in an area, which operate in three pairs, which are master and red slave station, master and green slave station and master and purple slave station. These are numbered and overprinted as coloured lattices on nautical charts. The stations transmit low-frequency (14.1666 kHz), unmodulated continuous wave (cw) signals in the form of radiating rings from the transmitting station. This is similar to the ripples generated by dropping a stone into a calm pond. The signals from the master-station and the relevant slave-station are of the same wave-length (frequency) and are transmitted in step by the stations.<sup>625</sup>

It was originally intended to erect seven shore stations in southern Africa, but only five were ever put into operation. This resulted in acute angles of intersection being observed at the greater distances from the coast with the resultant errors of positioning.<sup>626</sup>

This system ceased operation at the end of March 1998. The DECCA Navigator System is hyperbolic-hyperbolic. This means that the phase-difference of the transmissions is hyperbolae. DECCA and

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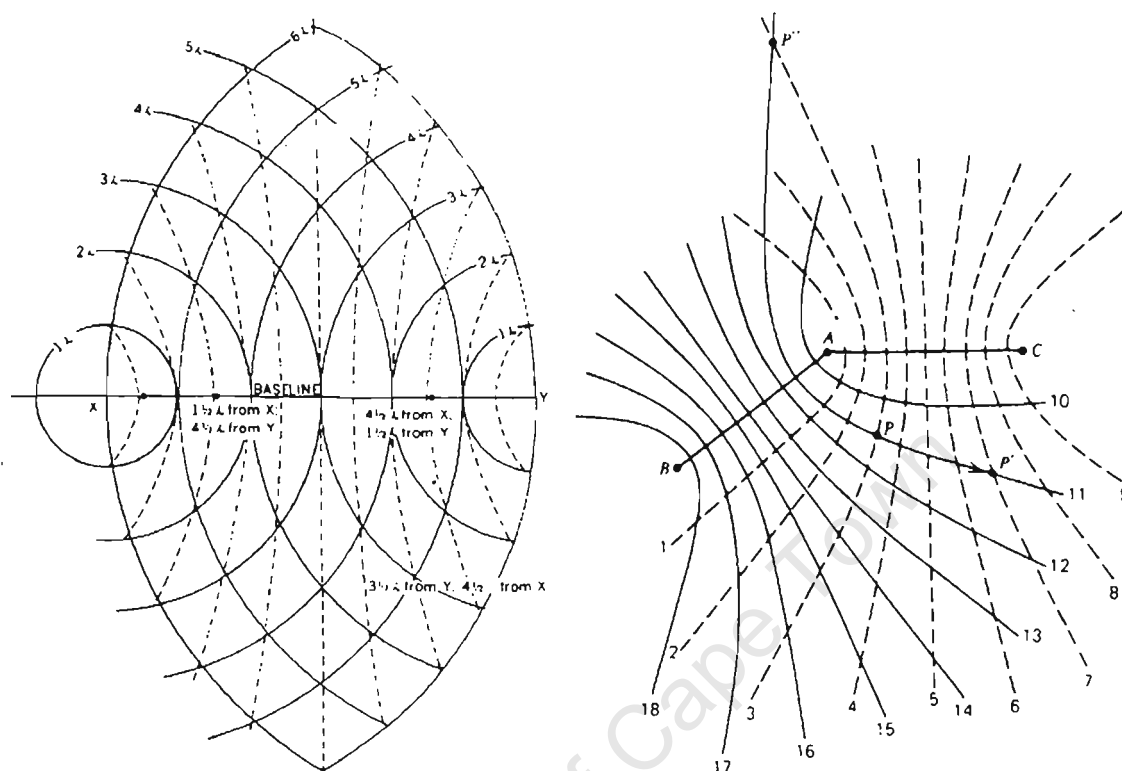
<sup>623</sup> S H Laurila Electronic Surveying and Navigation (1976) p43

<sup>624</sup> *ibid* p446

<sup>625</sup> The Decca Navigating Co Ltd The Decca Navigator Operating Instructions and Marine Data Sheets para 1.1 - 1.7.3, (September 1973), Laurila n613 p413

<sup>626</sup> TJ Morgan "The History of the Decca Navigator System in South Africa" Proceedings of the IALA RAD1 Conference (November 1995) p1-5

other similar systems have, in the past, been used for survey positioning and long-voyage navigation from terrestrial stations. A hyperbolic is the locus of a point that moves so that the difference of its indirect distance from two fixed points is always equal to a constant.<sup>627</sup>



**Figure 36 DECCA RECEPTION PATTERNS RESEMBLING WAVES CREATED BY STONES DROPPED INTO A POND**

(Also shown is the principle of hyperbolic location. A and B are transmitting stations with the position of the vessel being indicated at P, P' or P''. Transmitter C is required to finally fix the position.)

The hyperbolic location methods are divided into two types with distance differences calculated from pulse-type equipment (Loran) or by comparing phase differences of continuous unmodulated waves (DECCA).<sup>628</sup> Loran does however use the same low frequency travel as DECCA. DECCA, with greater output power, could operate up to distances of 1000 km from its transmitters. Loran C can operate up to 2000 km using ground waves and between 4000 and 5000 km using sky waves.<sup>629</sup>

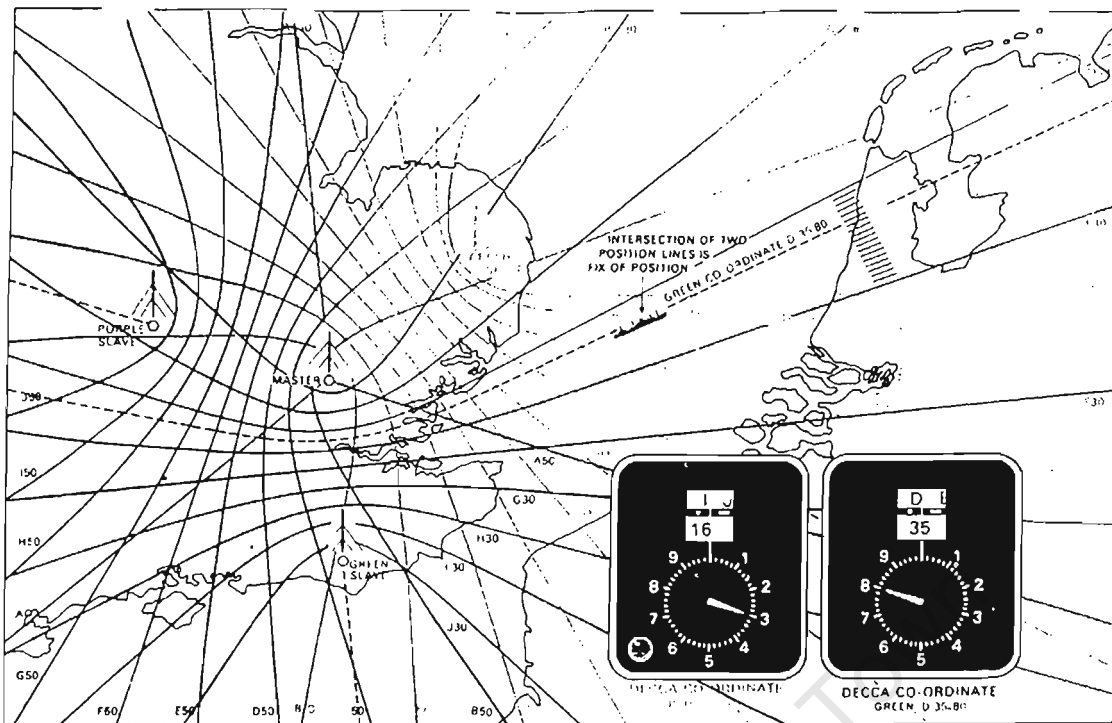
The DECCA system makes it possible for phase-measuring instruments to establish positions at varying distances from the transmitters. The receivers have separate position line indicators (decametres) for each chain and continuously receive and display the position line passing through the vessels receiver. The surveyor or navigator reads two of the decametres with the best angle of cut and by using the DECCA lattice on the chart he is able to plot the vessel's position at any time.

The units in which the decametres and the chart lattices are marked are known as 'Lanes'. A full revolution of the decametre is required for each Lane and is graduated to 1/100th of the Lane. When the vessel passes from one Lane to the next, the decametre automatically adjusts to the new lane.

<sup>627</sup> ibid p86

<sup>628</sup> ibid

<sup>629</sup> ibid p151



**Figure 37 DECCA PATTERNS SUPERIMPOSED ON A CHART  
(With a view of the Decimetres)**

It is necessary to reset the Decametre Zone Indicators prior to sailing, and when changing from one DECCA chain to another. An approximate position of the vessel is necessary to be able to reset the decametres. This will have to be obtained by one of a number of navigational methods. The position so derived is plotted on the chart and the correct lanes identified. The decametres are then set to read these lanes. The fraction indicator automatically adjusts when a lane setting is adjusted.<sup>630</sup>

## **DECCA Errors**

### **Fixed Errors**

These errors are as a result of a constant difference being noted between observed positions. It is a constant bias error related to the particular transmitters and receivers and a correction can be permanently set on the system.

Fixed errors can also occur as a result of the effect on these radio waves of the terrain surrounding the transmitters. These distortions can be periodically measured and correction tables or graphs supplied. As the errors are derived from the comparison of observed chart positions and accurate positions determined from the same geodetic survey network used to establish the positions of the transmitters, the errors contained in the survey and projection used in the chart are not accounted for. In recent well-compiled charts such errors should not normally be of a magnitude that need be considered but older, less accurately produced charts could account for significant errors.

If these positions were, or are, to be used in a delimitation process, then they may be of some significance depending on the reliability of the determination of the fixed errors. For normal navigational purposes the errors are applied to each reading of the Decametre.<sup>631</sup>

<sup>630</sup> ibid para 2.3.3 - 2.3.5

<sup>631</sup> ibid para 1.7.1

## Variable Errors

Radio signals are received from the direct or ground wave across the land and from the surface of the sea. They are affected, in certain circumstances in both day and night, by the radio wave being reflected off the ionosphere. This unwanted indirect or skywave interferes with the direct wave and could cause the receiving Decametre to give an erroneous reading.

The magnitude of the errors is difficult to determine as they may vary in both amplitude and phase. They will also vary diurnally and seasonally. The amplitude error could be reasonably predicted within certain confidence levels, but the phase variation is indeterminate and the only advice given to navigators is to be aware of the effect of possible errors when they are manoeuvring in difficult circumstances or conditions. This may suffice for a navigator, but not for a surveyor requiring positions of greater accuracy. Many early surveys were undertaken using the Decca Navigator System and many charts, some still in use, were compiled from information taken from these surveys.<sup>632</sup>

Other terrestrial positioning systems have been used in hydrographic surveys with very similar degrees of accuracy.

## Loran A

The Loran A system was developed during World War II and with Decca was used during the D-Day landings of June 1944. There was no developed system known as Loran B and Loran A was superseded by Loran C, which is more accurate and efficient.

## Loran C

The Loran C transmitting stations comprise high-power transmitters, timer/synchronisers and antennas. The transmitters are sometimes fitted with 190 metre top-loaded, vertical, monopole antennas and some have been used in conjunction with 411 metre vertical, monopole, antennas.<sup>633</sup>

Loran C operates at 100 kHz and usually consists of a number of chains with a master station and secondary stations. These stations could be up to 2000 km apart. The system measures the difference in the time of arrival of synchronised pulsed signals from the master and secondary stations and also the difference in the place of the synchronised carrier in the pulses from the station. The 'line of position' (LOP) is achieved by a two-stage operation. Firstly, a rough position is determined by identifying sampling points on the envelope of the pulse and by measuring the time difference between them. Secondly, the differences in the 100 kHz signals at the sampling points is measured giving a good indication of the position. The final determination is obtained by adding the two determinations together.<sup>634</sup>

As a pulsed system it is easier to distinguish between the primary ground wave signal and its skywave than with the continuous unmodulated wave systems.

## Differential Loran C

This is achieved by introducing additional geodetically fixed monitor receivers in the area. These fixed stations are then used to evaluate the accuracy of the Loran C reception in the area and to the corrections transmitted to the receivers requiring it. This is similar to the Omega System.<sup>635</sup>

In an analysis of Loran C in the Lower St Lawrence area of Canada, the following time- and position-dependent effects were recorded.

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<sup>632</sup> *ibid* para 1.7.2

<sup>633</sup> *ibid* p430

<sup>634</sup> *ibid* p424

<sup>635</sup> G Lachapelle et al "Analysis and Calibration of the Loran C Signals in the Lower St Lawrence Area using GPS" *IHR Monaco LXX(2)* (September 1993) p8

### Time-dependent Errors.

Time-dependent errors include;

- a. variations of troposphere refractivity along the propagation path due to weather variations of reasonable magnitude. At times the effect can be measured in metres;
- b. synchronisation of the signal, 10-17 metre effects were recorded;
- c. variations of conductivity of ground or ice have normally little effect unless humidity is a factor.<sup>636</sup>

### Position Dependent Errors

Errors that are position dependent could include atmospheric noise, caused by electric storms in the vicinity of the 90-110 kHz frequency band.<sup>637</sup>

Accuracy can be divided into three components;

- a) geometrical considerations which are similar to other terrestrial radio navigation systems;
- b) lack of knowledge of the 100 kHz propagation phenomena;
- c) instrumentation errors.<sup>638</sup>

### Navy Navigation Satellite System (NAVSAT also known as Transit)

This system was the forerunner to GPS. It comprised six operational satellites and the launch programme ended in 1988.<sup>639</sup> The satellites are in an circular polar orbit, 1075 km high, circling every 107 minutes. The system was designed so that each satellite was a self-contained navigation beacon.

It transmitted;

*two very stable frequencies, timing mark, and a navigation message that describes the satellite's position as a function of time. By receiving these signals during a single pass, the system user can calculate an accurate position fix.*<sup>640</sup>

The time of the pass varied and in southern Africa the duration was approximately 20 minutes. The system relied on the measurement of the Doppler frequency shift caused by the satellites motion. Although the satellites are still in orbit the system ceased operating in 1996.<sup>641</sup>

### Global Positioning System (GPS)

The most recent development in positioning is by means of processing data received from satellites. This system is based on a constellation of 24 US military satellites now fully deployed.<sup>642</sup>

For security reasons these signals were intentionally degraded and this led to a substantial reduction inaccuracy. The degradation is of the order of 100 metres but could, in certain circumstances, be substantially more. The satellites are orbiting about 20 200 km above the earth in such a manner that

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<sup>636</sup> ibid

<sup>637</sup> ibid p9

<sup>638</sup> Laurila n613 p434

<sup>639</sup> Bowditch n194 p793

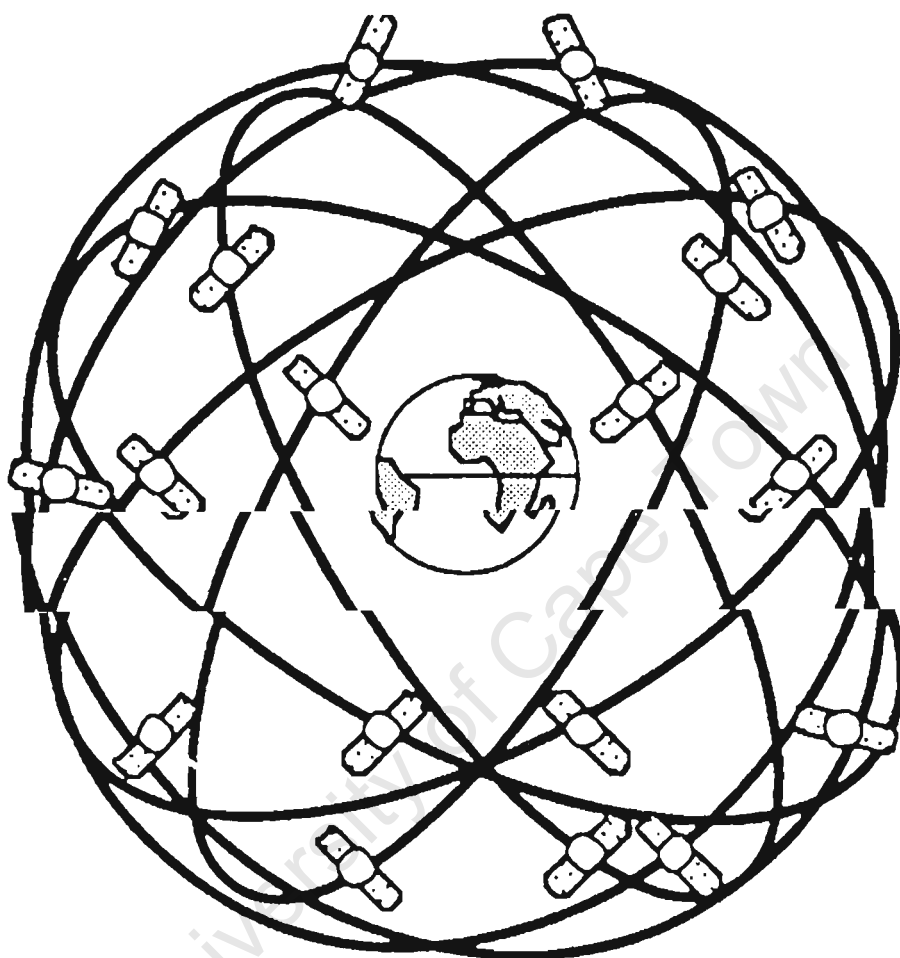
<sup>640</sup> Laurila n613 p468

<sup>641</sup> ibid

<sup>642</sup> Sercel - Inc (France) The High Accuracy of Positioning : Technical Specifications (undated)



they take precisely half the time of an earth rotation (11h 58m 02s) to complete an orbit.<sup>643</sup> There are a minimum of four satellites in each of the six orbital planes. This constellation ensures that an observer should be able to receive signals from a minimum of 4 satellites simultaneously at any time. By observing the time of arrival of the signals from the satellites the user's receiver will be able to compute the latitude, longitude and altitude of the receiver's position and the time. To an earth observer a particular satellite will be visible for between 5 to 12 hours. The number of satellites visible will vary from time to time.<sup>644</sup>



**Figure 38 THE FINAL 'GPS' SATELLITE SYSTEM CONFIGURATION**

To obviate the intentional degradation of the signal Differential GPS (DGPS) has been developed for regional or local purposes. A shore station, at a fixed position, provides corrections to the signals received from the satellite. In this system a well-fixed station provides adjustments to the signals received from the satellite for a region and improves the accuracy significantly.

In the consideration of this system a definition of term 'positioning' is necessary.

*Points can be positioned either individually or as part of a whole network of points; the positions sought may be either absolute (with respect to a co-ordinate system) or relative (with respect to other points).<sup>645</sup>*

<sup>643</sup> T A Stansell "The Global Positioning System" IHR Monaco LXII(2)(July 1986) p54

<sup>644</sup> D Wells (ed) Guide to GPS Positioning (1987) p4.5

<sup>645</sup> Vanicek n162 p46

### Point (Absolute) Positioning

This form of positioning relates data obtained from a satellite to the determination on the earth's surface. It does not matter which co-ordinate system is used, but it is usual to use a geocentric system. This is a system whose origin coincides with the centre of the mass of the earth. The term 'absolute position' is therefore sometimes used.<sup>646</sup>

### Relative Positioning

This is normally the standard terrestrial survey method. Any local co-ordinate system can be used for this method.

### Confidence Regions and Proportional Error Representations.

These are methods of quantifying the accuracy of positions. If a three-dimensional figure is considered, then the confidence region is an ellipsoid and if it is two-dimensional then it is an ellipse.

The proportional-error method is to consider the standard position error in a desired direction and then to divide it by the distance from the point to the origin of the co-ordinate system used. This form of quantification is obviously based on equating known positional errors to the system used and by accepting that like errors will be found in certain areas. The probability and extent of error can be interpolated and taken into account.

### Dilution of Precision (DOP)

DOP is a frequently used concept to describe accuracy. DOP is a measure of the geometric strength of the position fix and is a function of satellite geometry.<sup>647</sup>

Where  $\underline{Qx}$  is the cofactor matrix  $\underline{Qx} = (\underline{A}^T \underline{A})^{-1}$ <sup>648</sup>

$$DOP = \sqrt{\text{TRACE}(\underline{A}^T \underline{A})^{-1}}$$

$\underline{A}$  is the design matrix for the solution and is dependent on the satellite/receiver geometry.

Additional dilution of precision are categorised as follows;

GDOP (three position co-ordinates plus clock offset in the solution)

PDOP (three co-ordinates)

HDOP (two horizontal co-ordinates)

VDOP (height only)

TDOP (clock offset only)

HTDOP (horizontal position and time).<sup>649</sup>

Some of the basic functions of the GPS satellite are to;

- a) receive and store information transmitted by the control segment i.e., by the operators of the system;
- b) do limited data processing on board by means of its microprocessor;
- c) maintain very accurate time by means of several oscillators (two cesium, two rubidium) carried on board;
- d) transmit information to the user by means of various signals;

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<sup>646</sup> Wells n634 p1.1

<sup>647</sup> ibid p4.22

<sup>648</sup> B Hofmann-Wellenhof, H Lichtenegger and J Collins GPS Theory and Practice (1992) 224

<sup>649</sup> ibid

- e) manoeuvre by means of thrusters controlled by the system operations.

The satellite is powered by solar batteries with panels expanded to cover 7.25 square metres.<sup>650</sup>

### Control Stations

The satellites are controlled from five control stations in Hawaii (North Pacific Ocean), Colorado Springs(USA), Ascension Island (South Atlantic Ocean), Diego Garcia Island (North Indian Ocean) and Kwajalein Island (Central Pacific Ocean).

These stations carry out three functions;

- a) all five stations are monitor stations, tracking all GPS signals for use in controlling the satellites and predicting their orbits. The tracking is done by means of two frequency receivers equipped with cesium oscillators. Meteorological data is also collected to allow for the most accurate evaluation of tropospheric delays. Positions of these monitor stations are known to a very high degree of accuracy.
- b) Three of the stations (Ascension, Diego Garcia and Kwajalein) are capable of transmitting data up to the satellites, including new ephemeris ( A statement presenting positions and related data for a celestial body for given epochs at uniform time intervals),<sup>651</sup> clock corrections, and other broadcast message data and command telemetry.
- c) One station (Colorado Springs) is the Master Control Station.

The tracking stations transmit their data to the Master Control Station. Processing then computes satellite ephemeris and clock corrections. Orbital control of the satellite is also carried out by the Master Control Station. The satellites transmit on two frequencies for positioning purposes. The carriers are known as L1 and L2 and go out on frequencies of 1575.42 Mhz and 1227.60 Mhz. L1 is modulated by two codes, C/A code and either P Code or Y Code, but L2 has only the P or Y code.

These carriers carry the satellite-navigation message at a low frequency 50 Hz. The message contains a stream of data about the condition and the position of the satellite. The data will give a receiver a real-time position-line as part of the position-fixing process.<sup>652</sup> Satellite transmissions are, however, one-way ranging and each transmitter and receiver has its own clock. A transmitter will time the emission, a receiver the time of reception. This necessitates extremely accurate synchronisation of the clocks as 1 microsecond creates an error of 300 metres in the range from the satellite to the receiver.<sup>653</sup>

As it is virtually impossible to synchronise these clocks to that accuracy, the difference is applied mathematically. The monitoring of the difference in the various satellite clocks is one of the functions of the ground stations. They must determine the corrections mathematically and include this information in the message from the satellite to the receiver or user. These adjustments to synchronise the satellite clocks will mean that at a particular time all the satellite transmissions will be at the same time on a fictitious clock. A GPS receiver can make only two types of measurement, pseudo-range and carrier-beat phase, but these are not relevant to the accuracy of the system. GPS is used to position both static and kinematic (moving)objects. The later application will introduce additional differences.

A stationary object allows for many observations over as long a period of time as desired. This, in turn, allows for the discard or redundancy of the excess of poor satellite-positional ranges. A

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<sup>650</sup> Wells n634 p4.01

<sup>651</sup> IHO Dictionary n353 p77

<sup>652</sup> Wells n634 p4.10

<sup>653</sup> ibid p4.12

kinematic object will usually only allow for instantaneous ranges from satellites with no benefit of selection.

A number of variations are possible. Combinations of receivers with known relative-positions can simultaneously record data from the satellites. The results can be treated to a baseline adjustment and, where two or more receivers are used, to a network adjustment. The main consideration is the accuracy of the system. This is dependent on two factors, satellite configuration, and ranging accuracy.<sup>654</sup>

Dilution of Precision (DOP) has many variables, but for this evaluation it is sufficient to note that the positions of the satellite in relation to a receiver could be such that a poor or a good configuration is possible in the same way that known terrestrial points could be. Poor satellite positions would result in poor GDOP and *vice versa*.<sup>655</sup> GDOP is the accuracy in 3D position and time (Geometrical)

The system operators claim an accuracy of 50m, but this is primarily a defence guidance system managed by the US Military with built-in selective availability (SA). It could result, with poor satellite configuration, in errors of the order of 100 metres horizontally and 150 metres vertically. There is no guarantee that greater errors will not be experienced. Phase 1 testing in 1986 indicated the following.

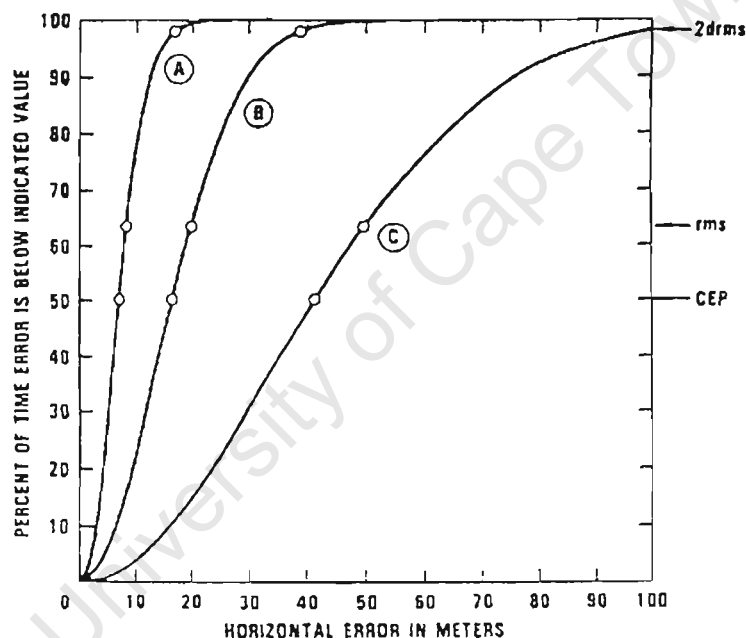


Figure 39 HORIZONTAL ERROR CURVES

#### Horizontal Errors

- Curve A - Multichannel, two frequency, P-Code receiver (Magnavox X set)
- Curve B - Single channel, slow sequencing, one frequency C/A Code (Magnavox Z set)
- Curve C - Planned level of SA accuracy denial of 100 metres for 95% of the time.<sup>656</sup>

The accuracy obtained and reflected in Curve B resulted in the decision to make the system available to civilian users, but with the planned accuracy denial of Curve C until there was no longer a security threat.

<sup>654</sup> ibid p4.22

<sup>655</sup> ibid

<sup>656</sup> Stansell n633 p5.7

Some of these biases and errors include the following;

- a) receiver clock bias - 10-100 metres;
- b) orbital bias - maximum 80 metres;
- c) ionospheric delay bias - 150 metres at the horizontal, decreases to 50 metres at the zenith;
- d) carrier-beat phase bias - variable.<sup>657</sup>

These are combined into a range bias and can be quite sizeable. This is dependent on the instrumentation used and how the range is determined. In addition the following factors must be considered;

### **Cycle slips**

For carrier-phase measurement, when a transmission is interrupted and re-commenced, the system will infer that the tracking had been maintained during the interruption period. This would not be the case and an erroneous interpretation of the data would occur.

### **Multipath**

This is caused by a direct signal being received and subsequently the same signal is also received via a longer route. This could, perhaps, be off a reflected surface. It causes errors in reception and subsequent calculations.

### **Imaging**

This is the result of a receiver recording a signal reflected, as an image, by a nearby surface. The resulting amplitude and phase characteristics are then a combination of the real and imaginary signals

### **Phase Centre Movement**

The antenna phase centre (where the measurement actually takes place) is not necessarily at the mechanical centre of the antenna. The offset is not fixed and the phase centre's position varies depending upon the relative positions of the transmitter and the receiver. The error is small in good quality receivers.

### **Observation Errors**

These are due to limitations in the receiver's electronics and are of a random nature. The errors are proportional to the wavelength of the signal and may vary significantly in magnitude through the various ranges.

### **Station Co-ordinates**

The positions of the ground stations are never perfectly accurately known. They may, and should, be surveyed as accurately as possible and adjusted as and when necessary. The accuracy of the predicted orbits is dependent on the accuracy of the ground stations that are being used to position the satellites.<sup>658</sup> A re-evaluation of the position of a ground station will affect the calculation of the satellite's orbits, which in turn will affect the accuracy of all positioning done from the satellites.

### **Differential Global Positioning System (DGPS)**

Differential GPS (DGPS) operates in a similar manner to the other differential methods previously considered. DGPS measures the range error of every possible satellite that can be tracked at a fixed station and the corrections sent and applied to observations at unknown positions. After the corrections

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<sup>657</sup> Wells n634 p9.0 - 9.15

<sup>658</sup> ibid

have been applied to GPS observation it has been found that accuracy of 2-3 metres (5 metres at 95% confidence) are obtainable at ranges over 200 km from a fixed station.<sup>659</sup>

One station is regarded as sufficient for the differential location of many ship stations. An example of results achieved in the surveys in the South China Sea by the Republic of China Oceanographic Survey and Mapping are as listed below.

Point Number	GPS Point	Polar coord. Pnt.	Error
1	9839.24 5444.03	9841.36 5443.64	-2.1 0.4
2	9841.04 5461.09	9842.45 5459.26	-1.4 1.7
3	9836.73 5463.82	9838.60 5461.53	-1.9 2.3
4	9838.87 5467.48	9841.67 5466.26	-2.8 1.2
5	9847.51 5455.02	9846.21 5466.26	1.3 -1.3
6	9849.35 5455.93	9849.76 5458.06	-0.4 -2.1
7	9863.17 5461.45	9866.22 5461.23	3.0 0.2
8	9853.02 5463.56	9849.66 5464.61	3.3 -1.0
9	9855.79 5462.65	9854.45 5462.33	1.3 0.3
10	9803.08 5406.49	9803.55 5408.66	-0.5 -2.2
11	0068.31 5392.27	0065.27 5393.36	3.0 -1.1
12	300.02 5386.79	0298.85 5389.12	1.2 -2.3
13	0445.38 5382.92	0445.10 5383.90	0.3 -1.0
14	1023.08 5496.80	1019.45 5498.15	3.5 -1.3
15	1032.56 5629.57	1031.98 5627.25	0.6 2.3
16	1025.40 5781.48	1022.67 5778.07	2.7 3.4

Table 2

**ERROR TABLE OF OBSERVATIONS TAKEN USING 'DGPS'  
IN THE SOUTH CHINA SEA (Units of Error are in Metres)**

<sup>659</sup> Stansell n633 p61, L Kailong & W Jianwen "HSD-001 Real DGPS Ocean Survey Location System" *IHR Vol LXX(2)* (September 1993) p57

## SEISMIC SURVEYS

### INTRODUCTION

To determine the configuration of the seabed, its structures and in ice-covered areas, the foot of the slope, seismic surveys are necessary. The ideal concept of a simple continental margin will rarely be found. Active margins, such as are found off the coasts of Chile and Japan have convoluted continental slopes. Even passive margins can have configurations that make it difficult to identify a foot of the slope that can be used for a continental shelf claim in accordance with LOSC. An example is the major slumping off South Africa.

### METHODS

Wave motions propagated from a source by a shock or explosion can be divided into two types. There is a wave that vibrates longitudinally in the direction of travel called compressional or longitudinal waves and a second wave which vibrates at right angles to the direction of travel and is called a shear or transverse wave. The time recorded is for both the outward and the return journey and therefore half of the time must be used to determine the point of reflection of the wave.

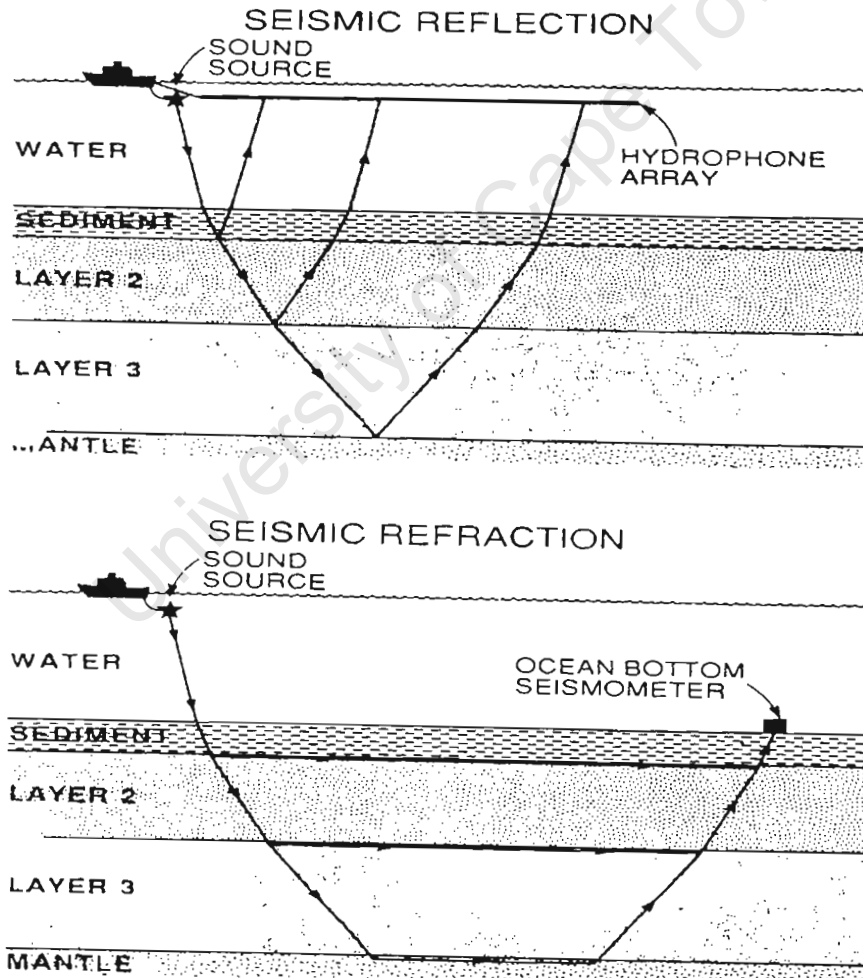


Figure 40 SEISMIC REFLECTION AND REFRACTION TECHNIQUES.  
(Reflection measures the wave arrival times and Refraction measures the difference in wave velocity)

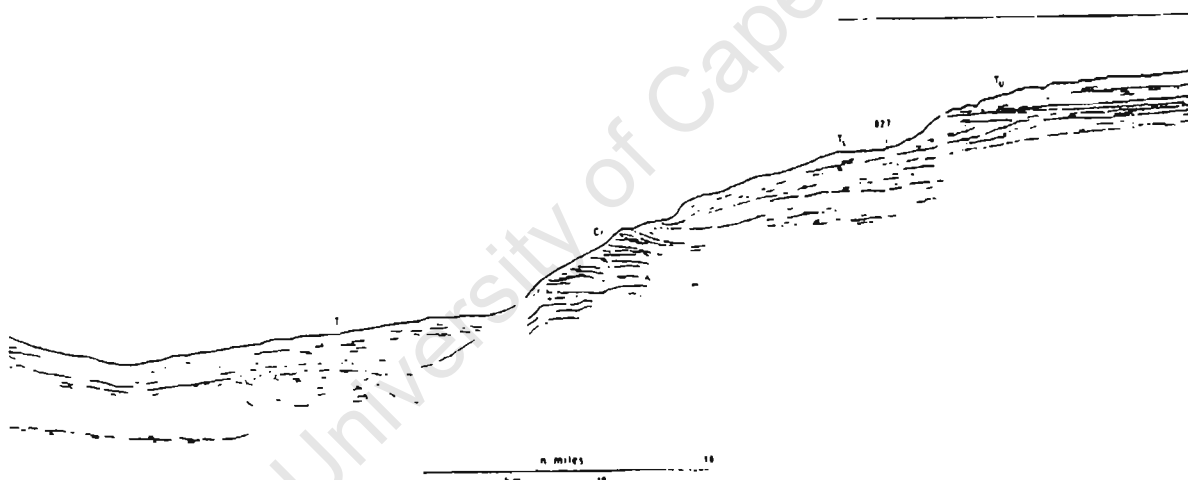
Marine seismic data acquisition has become more efficient by towing more than one source. By using paravanes it is possible to obtain more than one line of readings with each pass of the survey vessel. Those vessels involved in 3D surveys have positioning systems that can give an accuracy to within a few metres in a local system. <sup>660</sup>

### Seismic Refraction

Changes in recorded velocity of sonic-waves through geological structures, when related to depth, allow inferences to be made about the type and density of the material through which the wave has passed. First-wave arrival times are plotted and kinks in the travel-time curve will indicate changes in wave velocity and will also usually indicate changes in rock types or density. Increase in velocity usually indicates denser rock. If the rocks in the area being surveyed have different seismic velocity, this allows for their identification, extent and any faults that may exist in the structures. <sup>661</sup> The study of the deepest layers could require 'refraction shooting' with large explosive charges up to 100 kg of TNT. <sup>662</sup>

### Seismic Reflection <sup>663</sup>

Seismic-reflection surveys are based on the fact that a partial reflection of rays takes place at the rock layer boundaries. The reflected rays appear as echoes. They usually take a longer path and are recorded as late arrivals. The reflections are not accurate as the rays are reflected at different levels of the layer boundary. The deeper layers are recorded still later. The record of the reflections from artificial stations creating the rays, usually by explosions, is able to indicate the rock and sediment structures of the area.



**Figure 41 A PROFILE INDICATING THE PROBLEM OF IDENTIFYING THE 'FOOT OF THE SLOPE'**

At sea, this is achieved by artificial seismic shocks, usually created by explosions. The reflections are recorded on hydrophones on the ship. The position of both the explosion and the hydrophone is important and the criteria applicable to the survey of these positions, as indicated in this Chapter and Chapter IV, apply.

One of the larger energy sources used in reflection surveys is the 'air gun' which discharges a bubble of highly compressed air into water. By contrast the 'water gun' uses compressed air to drive a piston which creates a vacuum cavity in the water. The implosion of this cavity provides the pulse. The 'boomer' creates an implosion by using two plates being pulled apart to create an area of low pressure

<sup>660</sup> RE Sheriff & LP Geldart *Exploration Seismology* (2<sup>nd</sup> Ed) (1995) p22

<sup>661</sup> Dennis n401 p366

<sup>662</sup> Baretta-Bekker n456 p289

<sup>663</sup> *ibid* p368



between the plates. A 'sparker' is a spark created between electrodes which vaporises the water. This creates a small explosion. A 'penetrating echosounder' operates on a low frequency and is able to penetrate layers tens of metres below the seafloor.<sup>664</sup>

Seismic reflection is used to study subterranean features and it has improved the understanding of the geological structures of the sea-bed. While seismic observations will give an overview of possible problems an echo-sounder profile would provide the basis for a better determination of the slope.

The pulse should be 'sharp' to obtain optimum results and this may be difficult to obtain using an explosion. The pulse will be 'smeared' out as it travels over a number of kilometres. A second problem is caused by different reflecting layers trapping the sound energy between them delaying the return to the surface receiver. It is unlikely that multiple determinations can be made from the same detonation and receiving positions as on land. It is therefore not possible to produce sharper records of the seismic profiles taken at sea. It must be noted however that the best result that can be expected from both refraction and reflection surveys is not of the same order of accuracy achieved by other survey methods.<sup>665</sup>

*Results of seismic inversion techniques of deep-sea bore holes indicate that bottom simulating reflectors (BSRs) which exhibit high reflection amplitudes are underlain by a thin layer of free gas. Often, however, BSRs exhibit relatively low amplitudes and display significant lateral variability. In these cases the structure is not well understood.*<sup>666</sup>

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<sup>664</sup> Baretta-Bekker n456 p290

<sup>665</sup> AR Camina & GJ Janacek Mathematics for Seismic Data Processing and Interpretation (1984)pxvi

<sup>666</sup> TM McGee "A Single-Channel Seismic Reflection Method for Quantifying Lateral Variations in BSR Reflectivity" Marine Geology 164 (February 1999) p29

The following is an example of the types of cross section or seismic profiles that can be expected.

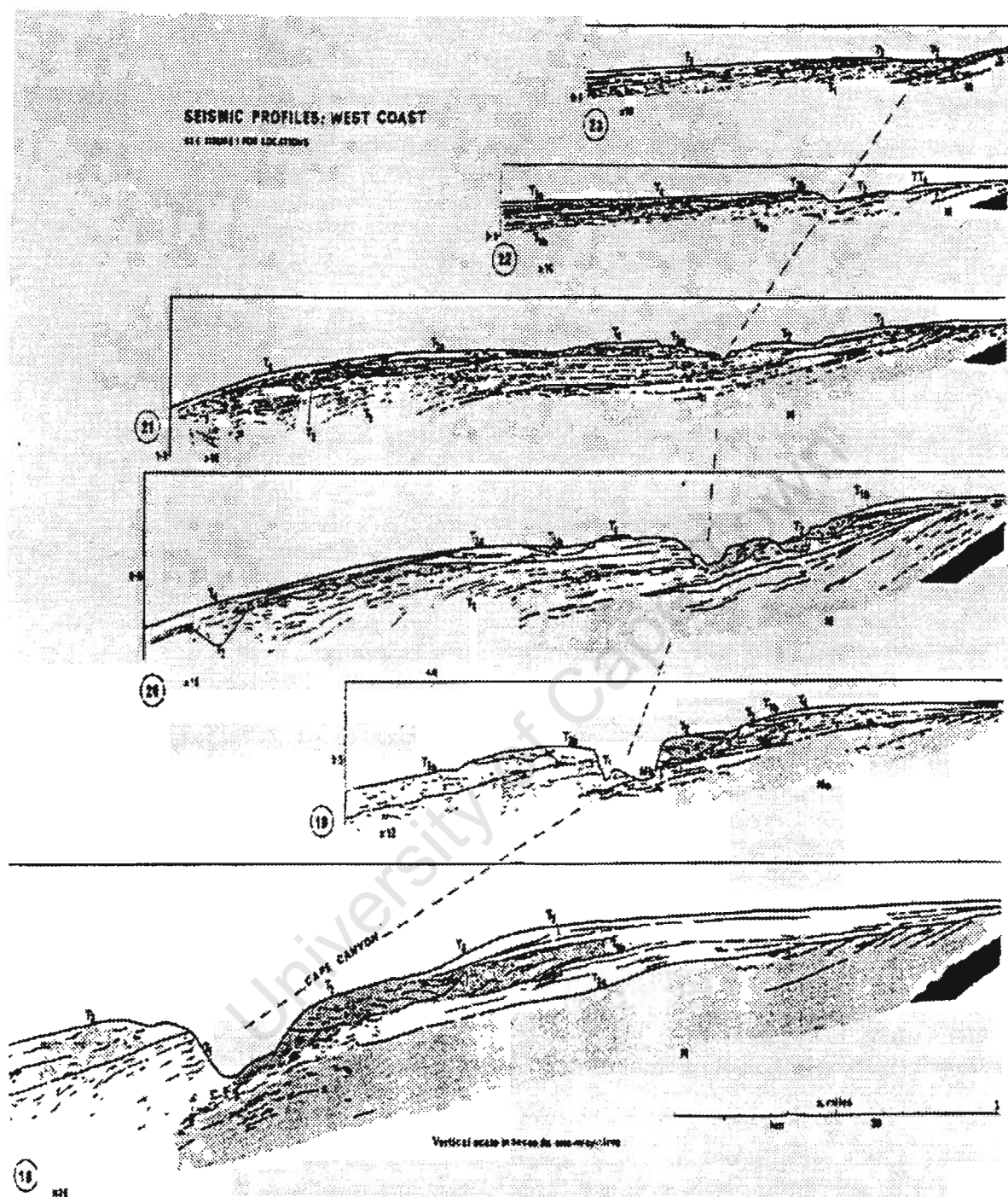


Figure 42 SEISMIC PROFILES USED TO DETERMINE THE POSITION OF THE 'CAPE CANYON'

It is possible to integrate observations into a 3-dimensional model from the seismic observations taken from a number of vessels, airgun arrangements, or streamers and tailbuoy assemblies. Almost any data can be collated provided the time adjustments are known. The amount of data that could be utilised has to be increased dramatically, in most instances up to 30 times that previously used for the 2-dimensional profiling.

In addition the data types have quadrupled and include the following;

- a) the ranges of the vessels to the shore stations, master and slave and other beacons used for fixing its position;
- b) the bearings used for fixing;
- c) pseudo-ranges involving the vessel and the shore station, pseudo-ranges and range differences between shore station and floating stations and the pseudo ranges and range differences between moving reference stations and vessels;
- d) carrier wave and doppler counts of satellite signals;
- e) navigational variables;
- f) variables in the control of the position of the seismic equipment in relation to the vessel.<sup>667</sup>

A number of factors affect seismic reflection and refraction surveys. Some are as follows:

**Absorption:**

*In reality, as the wave motion passes through the medium, the elastic energy associated with the wave motion is gradually absorbed by the medium, reappearing ultimately in the form of heat*<sup>668</sup>

**Effect of Interstitial Fluid:**

*Porous rocks are almost always saturated with fluids, generally salt water, the pores in oil and gas reservoirs being filled with varying amounts of water, oil and gas.*

**Reflected Refraction:**

*Where a refractor is terminated the head wave will be reflected backward. It may appear on the later portion of a reflection record some distance from the actual refractor termination.*<sup>669</sup>

**Rugged Terrain:**

*An example is the jumbled masses have come to rest at the foot of the slope and now form a part of the continental rise. The seismic profile was obtained by echo-sounding 'into the seafloor' with powerful 'booms' of sound, rather than the 'pings' used to define the surface of the floor. (This method is called continuous seismic profiling.)*<sup>670</sup>

**Pseudo-Range**

This effect is similar to that occurring in sidescan-sonar operations where the range along the hypotenuse is recorded instead of the required horizontal or vertical component.

**Processing**

Marine data can be acquired in both 2D and 3D format. The 3D seismic survey provides a large volume of data for processing. The processing of the 3D data is similar to that of 2D data in most aspects. A number of additional corrections must be applied however such as, dipmoveout (DMO) which is required to remove reflection-poiny smear.<sup>671</sup>

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<sup>667</sup> Attributed to APEM Houtenbos" Integrated Processing of 3D Marine Seismic Positioning Data" (Shell Internationale Petroleum Maatschappij) p13

<sup>668</sup> Sheriff n657 p59

<sup>669</sup> ibid p121 & 171

<sup>670</sup> Seibold n357 p59

<sup>671</sup> Sheriff n654 p452 & 457

## COMMENTED GLOSSARY TERMS RELEVANT TO SURVEY USED IN LOSC

(Unless otherwise stated all definitions are taken from AJ Kerr, NR Guy et al IHO Manual on Technical Aspects of United Nations Convention on Law of the Sea 1982 3rd Ed 1993.)

### CHART

*A nautical chart is specially designed to meet the needs of marine navigation. It depicts such information as depths of water, nature of the seabed, configuration and nature of the coast, dangers and aids to, navigation, in a standardised format; also called simply Chart.*

#### Comment

The nautical chart (Chart) is not a map. It is a navigational aid and its sole purpose is safety of navigation. Charts exist for the entire sea, ocean, and water areas of the earth's surface but the scale, projection, and data density are requirements set by the navigators. In many instances these are the only charts or maps available for delimitation purposes. The role of charts are considered in greater detail in Chapter IX.

### CLOSING LINE

*A dividing line between the internal waters and the territorial seas of a coastal State enclosing a river mouth,<sup>672</sup> a bay,<sup>673</sup> or a harbour,<sup>674</sup> or the archipelagic waters of an archipelagic State.<sup>675</sup>*

#### Comment

LOSC confines the use of the term 'closing line' to archipelagic States but recent usage has included lines closing bays, river mouths and harbours generally.

### DELIMITATION

*The determination of a maritime boundary between States effected by agreement judicial decision or arbitration award.*

#### Comment

Delimitation is considered in greater detail in Chapter VIII which is titled 'Delimitation'. The limits of each zone of a coastal State have to be determined for enforcement of national legislation to be effective. Where more than one State is concerned the delimitation is usually based on median line or equidistant.<sup>676</sup> A delimitation should be equitable. Failing agreement between States that are opposite or adjacent and providing historic title is not claimed in the area, States may not claim beyond a median line.<sup>677</sup> Points on this median line must be equidistant to the nearest points on the coasts of the States concerned.

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<sup>672</sup> LOSC Article 9

<sup>673</sup> LOSC Article 10

<sup>674</sup> LOSC Article 11

<sup>675</sup> LOSC Article 50

<sup>676</sup> LOSC Article 15

<sup>677</sup> ibid

## EQUIDISTANCE (Median Line)

*A line every point of which is equidistant from the nearest points on the baselines of the two States.*<sup>678</sup>

### Comment

The term 'equidistant line' is usually associated with boundaries between adjacent States and a 'median line' with a boundary between opposite States.<sup>679</sup> Equidistant is the most common method used but concavity of a coastline or the presence of a small island close to the coast could result in an equidistant solution being inequitable. See Chapter VIII for more detail.

## HYDROGRAPHIC SURVEYING

*The science of measuring and depicting those parameters necessary to describe the precise nature and configuration of the seabed and coastal strip, its geographical relationship to the landmass, and the characteristics and dynamics of the sea.*

*Hydrographic surveys may be necessary to determine the features that constitute baselines or basepoints and their geographical positions.*

*During innocent passage, transit passage, and archipelagic sea-lane passage, foreign ships, including marine scientific research and hydrographic survey ships, may not carry out any research or survey activities without the prior authorisation of the coastal states.*

### Comment

Hydrographic surveying and seismic surveying are the two essential survey disciplines necessary to establish maritime zones.

## ISOBATH

*A line representing the horizontal contour of the sea-bed at a given depth.*

### Comment

The only isobath referred to in LOSC is the 2500 metre isobath which is a baseline for one of the limiting criteria in determining the outer limit of a continental shelf claim.<sup>680</sup> A 2500 metre isobath is a contour line of 2500 metre depths in the ocean.

## NAUTICAL MILE

*A unit of distance used primarily in navigation. Most maritime nations have accepted the international nautical mile of 1852 metres adopted by the International Hydrographic Organisation.*

### Comment

This is the unit of measure used by mariners and marine cartographers. It is also the horizontal unit of measure contained in LOSC. This has been considered in depth in Chapter IV.

## PARALLEL OF LATITUDE

*A circle (or approximation of a circle) on the surface of the EARTH, parallel to the EQUATOR and connecting points of equal LATITUDE.*<sup>681</sup>

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<sup>678</sup> *ibid*

<sup>679</sup> *ibid*

<sup>680</sup> LOSC Article 76 (5)

<sup>681</sup> IHO Dictionary n353 p169

## Comment

This term is not used in LOSC but States have adopted parallels of latitude as lateral boundaries.<sup>682</sup> The problems associated with this practice have been considered in Chapter IV. Astronomical latitude and longitude relate to the mean axis of rotation of the earth and the direction of the local plumb-line vertical. Latitude is the angle this vertical makes with a plane normal to the rotation axis. Longitude is the angle that a plane containing this vertical and a line parallel to the rotation axis makes with a reference plane through the rotation axis (the Greenwich Meridian plane).

Geodetic latitude and longitude are similarly defined with the earth's rotation axis replaced by that of the reference ellipsoid (the z-axis), the plumb-line vertical replaced by the x, z co-ordinate plane of the reference ellipsoid.

Latitude varies from 0 to 90 degrees North or South of the equator, lines joining all points of equal latitude are known as parallels of latitude (or just parallels).

## LONGITUDE

*Longitude is an angular distance, the angle is subtended at the Poles and is measured between the Greenwich Meridian and the meridian through the point. It varies from 0 to 180 degrees East or West of the Greenwich Meridian. Lines joining all points of equal longitude are known as meridians.*<sup>683</sup>

## Comment

The most common system of co-ordinates are those of latitude and longitude, although rectangular co-ordinates on the Universal Transverse Mercator Grid (quoting the appropriate Zone number), Marsden Squares, Polargrid Co-ordinates etc. are also unambiguous. The Preparatory Commission has under consideration that applications for plans of work should define the areas by reference to the global system WGS 84.<sup>684</sup> The Agreement on the application of Part XI of LOSC is considered in detail in Chapter XII.

## SIZE OF AREA

*The general requirements are laid down in Annex III Art. 8 and 17.2 (a) of the convention. The first of these articles requires that the applicant shall indicate the co-ordinates dividing the area.*

## Comment

Although the Area falls under the jurisdiction of the Authority established in accordance with LOSC,<sup>685</sup> the limits of national jurisdiction are established by coastal States. The size of the Area is therefore the remainder of the sea-bed after all coastal States have established their outer limits. The Authority does not determine the size of the Area, but it may contest the extent of a claim by a coastal State.

## SUBMARINE CABLES

*An insulated, waterproof wire or bundle of wires or fibre optics for carrying an electric current or a message under water.*

*They are laid on or in the seabed, and the most common are telegraph or telephone cables, but they may also be carrying high voltage electric currents for national power distribution or to offshore islands or structures.*

<sup>682</sup> Gambia/Senegal n248, Columbia/Ecuador n248

<sup>683</sup> IHO Dictionary n353 p134

<sup>684</sup> Article 2.12 of Draft Regulations on Prospecting, Exploration and Exploitation of Polymetallic Nodules in the Area, UN File No LOS/PCN/SCN. 3WP 6

<sup>685</sup> LOSC Article 156

*They are usually shown on charts if they lie in area where they may be damaged by vessels anchoring or trawling.*

*All states are entitled to lay submarine cables on the continental shelf subject to the provisions of Article 79.*

*Articles 113, 114 and 115 provide for the protection of submarine cables and indemnity for loss incurred in avoiding injury to them.*

#### **Comment**

Although satellite communications are now often preferred to the standard underwater telephone, many submarine cables are still in use. 9 500 km of new fibre-optic cable has recently been laid between Melkbosstrand, near Cape Town South Africa and Europe via Madeira and the Canary Islands.<sup>686</sup>

The cables involve substantial investment by the States concerned.<sup>687</sup> Other submarine cables, that are used for high voltage or normal electricity are usually confined to territorial waters.<sup>688</sup>

#### **SUBMARINE PIPELINES**

*A line of pipes for conveying water, gas, oil etc, under water.*

*They are laid on or trenched into the seabed, and they could stand at some height above it. In areas of strong tidal streams and soft seabed material the seabed may be scoured from beneath sections of the pipe leaving them partially suspended.*

*They are usually shown on charts if they lie in areas where they may be damaged by vessels anchoring or trawling.*

*The delineation of the course for the laying of such pipelines on the continental shelf is subject to the consent of the coastal state.*

*Articles 113, 114 and 115 provide for the protection of submarine pipelines and indemnity for loss incurred in avoiding to them.*

*All states are entitled to lay submarine pipelines on the continental shelf subject to the provisions of Article 79.*

#### **Comment**

Submarine pipelines, particularly oil and gas pipelines are laid from islands or installations. These pipelines are not normally found over extensive areas of the seabed and are usually confined to the marine-geological continental shelf. They pose a tremendous threat to the environment and their safety and good maintenance is of concern to all coastal States.

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<sup>686</sup> Information supplied to me, verbally, by the Cable Station Manager, International Networks, Telkom, Melkbosstrand South Africa (January 1995)

<sup>687</sup> *ibid*

<sup>688</sup> *ibid*

# FUNCTIONAL APPLICATIONS OF NON-LEGAL ASPECTS IN LOSC

## CHAPTER VIII

### DELIMITATION AND QUESTIONS OF TITLE

#### INTRODUCTION

LOSC makes provision for the delimitation of the following zones: Internal waters, territorial waters or seas, contiguous zones, exclusive economic zones, LOSC continental shelves and archipelagic waters. Indirectly this demarcates the extent of the high seas, as the high seas are those areas beyond national jurisdiction.<sup>689</sup> Each has its own delimitation criteria and each has its own regime. This includes rights and privileges for the coastal and other States. Many of these rights and obligations relate to navigation and resources which will be dealt with in Chapters IX and X. While there are delimitation factors particular to each case, essential requirements common to all cases include accurate mapping of the coastlines. Mapping of the sea bed and undersea features, and in some instances marine-geological data is vital for the establishment of the outer limit of a LOSC Continental Shelf claim. The baselines from which all of these zones are measured are on the coast and while an LOSC continental shelf claim may be based on submarine features and the configuration of the continental margin one of the limiting criteria is distance measured from the baselines on the coast. The shape of the coast and the islands and low-tide elevations of adjacent and opposite States can affect delimitation. Median lines and lateral boundaries may be determined by baselines of more than one State.

#### BASELINES AND OUTER LIMITS

Under LOSC a baseline could be one of the following:

- a) the low water line or the 'normal' baseline,<sup>690</sup>
- b) straight baselines,<sup>691</sup>
- c) closing lines of bays,<sup>692</sup>
- d) archipelagic baselines.<sup>693</sup>

#### Normal Baselines (Low-Water Line)

The low-water line, when used as a baseline to determine a boundary, creates enormous problems for the surveyor and those involved with delimitation. The frequency when the lowest low-water occurs has been discussed in Chapter VII and compromises may have to be agreed upon by States delimiting a boundary.

<sup>689</sup> LOSC Articles 3, 8, 33(2), 47, 48, 49, 57, 76

<sup>690</sup> LOSC Article 5

<sup>691</sup> LOSC Article 7

<sup>692</sup> LOSC Article 10

<sup>693</sup> LOSC Article 47

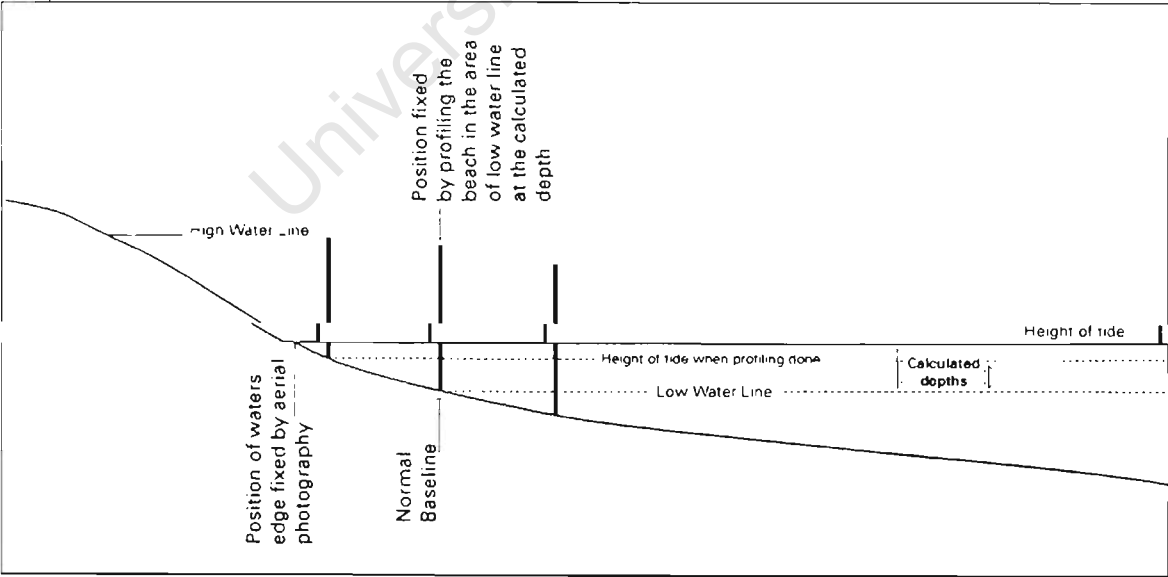


Distinct territorial advantages exist by adopting the lowest water line as a baseline or a straight baseline that originates on such a line. It will be shown that the practice of States makes it evident that the problems in determining the low water line have contributed to States adopting straight baselines wherever possible. The problems of using a low-water line have already been identified. Methods will now be considered that may offer acceptable solutions in a delimitation process.

It is not necessary to consider complicated methods of determining the lowest low-water line where little horizontal movement is experienced between extreme tides in an area. Where the beach profile is steep there would be little advantage in further surveys being undertaken. Aerial photography, taken at the lowest convenient tide, would suffice. Where, however, the beach profile is low and the tidal range large however it is possible that significant horizontal movement will be evident and it would be in the interest of the State to determine the position of the lowest possible low-water line.

One method would be to fix the position of the edge of the sea by aerial photogrammetry at the most convenient level of the tide. The time of the photography is recorded and the height of the tide above the lowest low water, usually Lowest Astronomical Tide (LAT), is determined. Beach profiles can then be determined by survey at acceptable intervals along the coast. LAT would then be related to the profile and a horizontal position of the LAT determined from the depth difference between LAT and the height of the tide at the time of the survey. It is therefore possible to position LAT at any time of the year. The distance between the profiles would be dependent on the configuration of the beach and the coast in general.

A major problem exists where the coast is permanently covered by ice and the edge of the coast and the profile of the tidal area is permanently hidden from the naked eye. As coastal States have to survey the low-water lines to determine the positions of any of the possible baselines, a combination of aerial photography, hydrographic surveying, conventional land surveying and seismic surveys may have to be used. Straight baselines may be drawn to replace the normal baselines where coastlines are deeply indented and cut into or if there is a fringe of islands along the coast in its immediate vicinity.<sup>694</sup>



**Figure 43 A METHOD FOR DETERMINING THE POSITION OF THE LOW-WATER-LINE AT ANY STATE OF THE TIDE**

<sup>694</sup> LOSC Article 7(1)

## Straight Line.

*Mathematically the line of shortest distance between two points in a specified space or on a specified surface.*<sup>695</sup>

Straight lines may be used to close bays and to replace the low-water line as the normal baseline. Care must be taken in the manner in which the co-ordinates of these lines are computed. If the straight line is relatively short it is possible to calculate, depict and relate to the line for everyday use without appreciable errors. As indicated in Chapter IV, however, geodetic methods of computation are essential to achieve internationally acceptable results, particularly where the straight baselines are long.

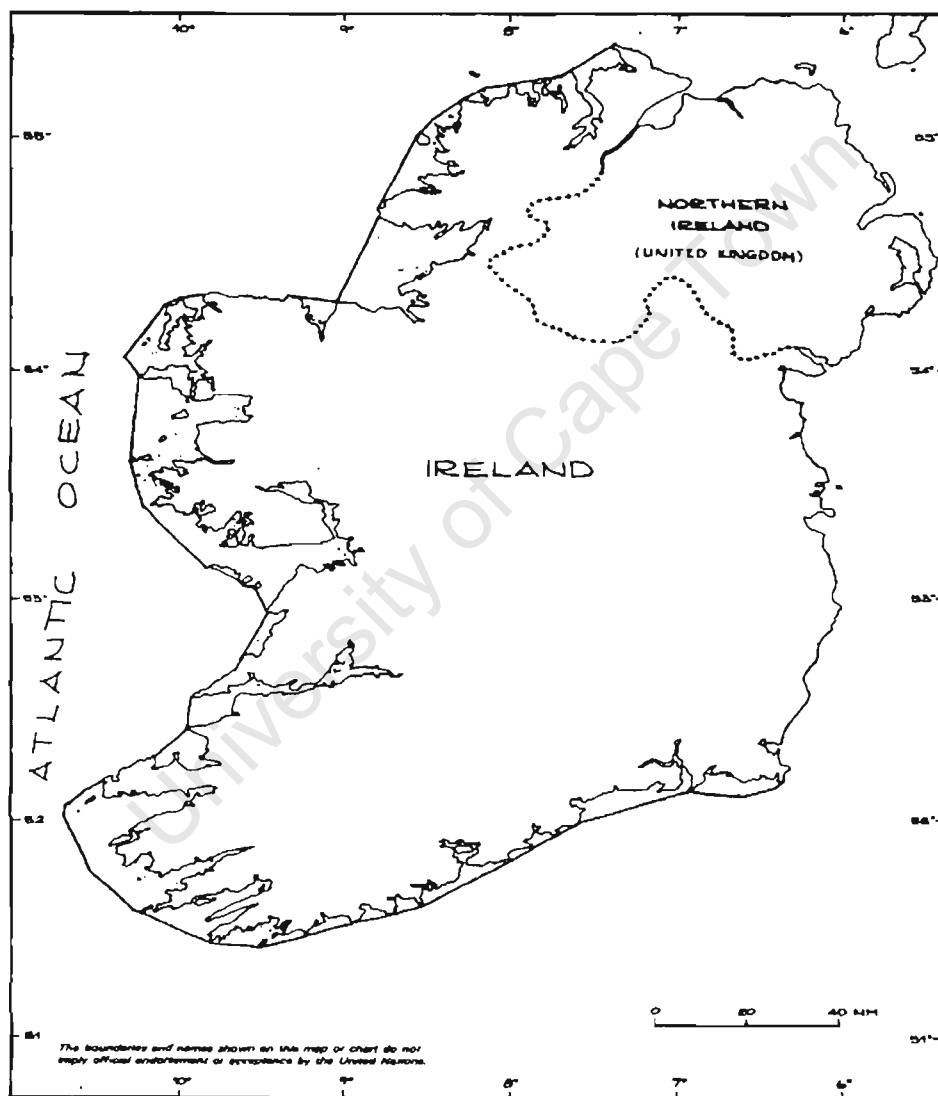


Figure 44 STRAIGHT BASELINES THAT FOLLOW THE GENERAL DIRECTION OF THE COAST

<sup>695</sup> IHO n192 p25

**Criteria for the use of straight baselines (as contained in LOSC) <sup>696</sup>**

- a) The straight baselines must not depart to any appreciable degree from the general direction of the coast.
- b) The sea areas enclosed inside these lines must also be sufficiently close to the land domain to be considered internal waters. <sup>697</sup>
- c) Where a coastline is unstable, perhaps as a result of an actively eroding an abandoned delta, positions that were fixed on the low-water line prior to the landward regression of the coast and the low-water line may be retained. The coastal State is expected to reconsider its position in the event that the regression becomes permanent. <sup>698</sup> Where major dams are constructed on rivers restricting the flow of sediment to a delta, there is every possibility that the delta could regress.
- d) Straight baselines may not cut off the territorial sea of another State from the high seas or an economic zone. <sup>699</sup>
- e) They may also not be drawn to a low tide elevation unless a lighthouse or a similar installation, which is permanently above high water, has been erected on it. <sup>700</sup>

Waters enclosed by straight baselines are considered to be internal waters, <sup>701</sup> but where these waters were not previously considered as internal waters and a right of innocent passage existed, this right will be retained. <sup>702</sup>

In the Marine Traffic Act 1981 <sup>703</sup> certain South African bays, namely Saldanha Bay, Hout Bay, False Bay, Knysna Lagoon, Bay of Natal and Richards Bay were named as being internal waters. <sup>704</sup> Although the natural entry points of these bays were never surveyed and co-ordinated, they have never been contested and this appears to consolidate their status as internal waters. Subsequently straight baselines were drawn around the southwest coast of South Africa from Cape Deseada, on the southwest coast, to just east of Bird Island on the southeast coast. Their co-ordinates appear as schedule 2 of the Maritime Zones Act 1994. <sup>705</sup>

With the exception of the above-named bays, the waters enclosed by these new baselines were previously considered to be territorial waters. Although these waters are now internal waters, the right of innocent passage through them is retained. <sup>706</sup>

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<sup>696</sup> LOSC Article 7(3)

<sup>697</sup> LOSC Article 7(3)

<sup>698</sup> LOSC Article 7(2)

<sup>699</sup> LOSC Article 7(6)

<sup>700</sup> LOSC Article 7(4)

<sup>701</sup> LOSC Article 8(1)

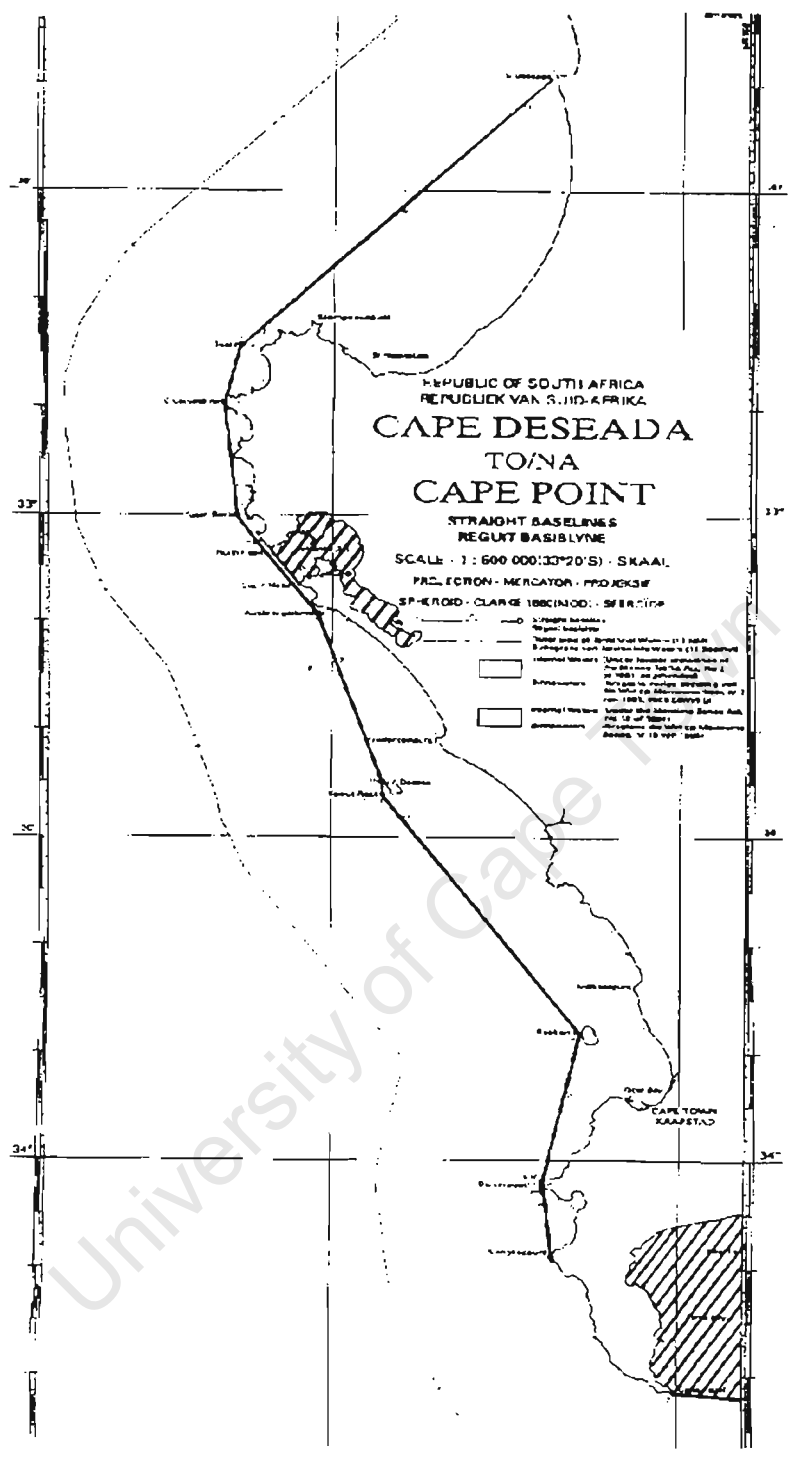
<sup>702</sup> LOSC Article 8(2)

<sup>703</sup> South African Marine Traffic Act No 2 (1981)

<sup>704</sup> *ibid*

<sup>705</sup> South African Maritime Zones Act No 15 (1994)

<sup>706</sup> *ibid*. LOSC Article 8(2), US Department of State "Developing Standard Guidelines for Evaluating Straight Baselines": Limits in the Seas (31 August 1987) No106



**Figure 45 A NUMBER OF STRAIGHT BASELINES DRAWN ON THE WEST COAST OF SOUTH AFRICA**

A number of instances are given in LOSC for the drawing of straight baselines;  
a) where a coastline is deeply indented and cut into;<sup>707</sup>

<sup>707</sup> LOSC Article 7(1)

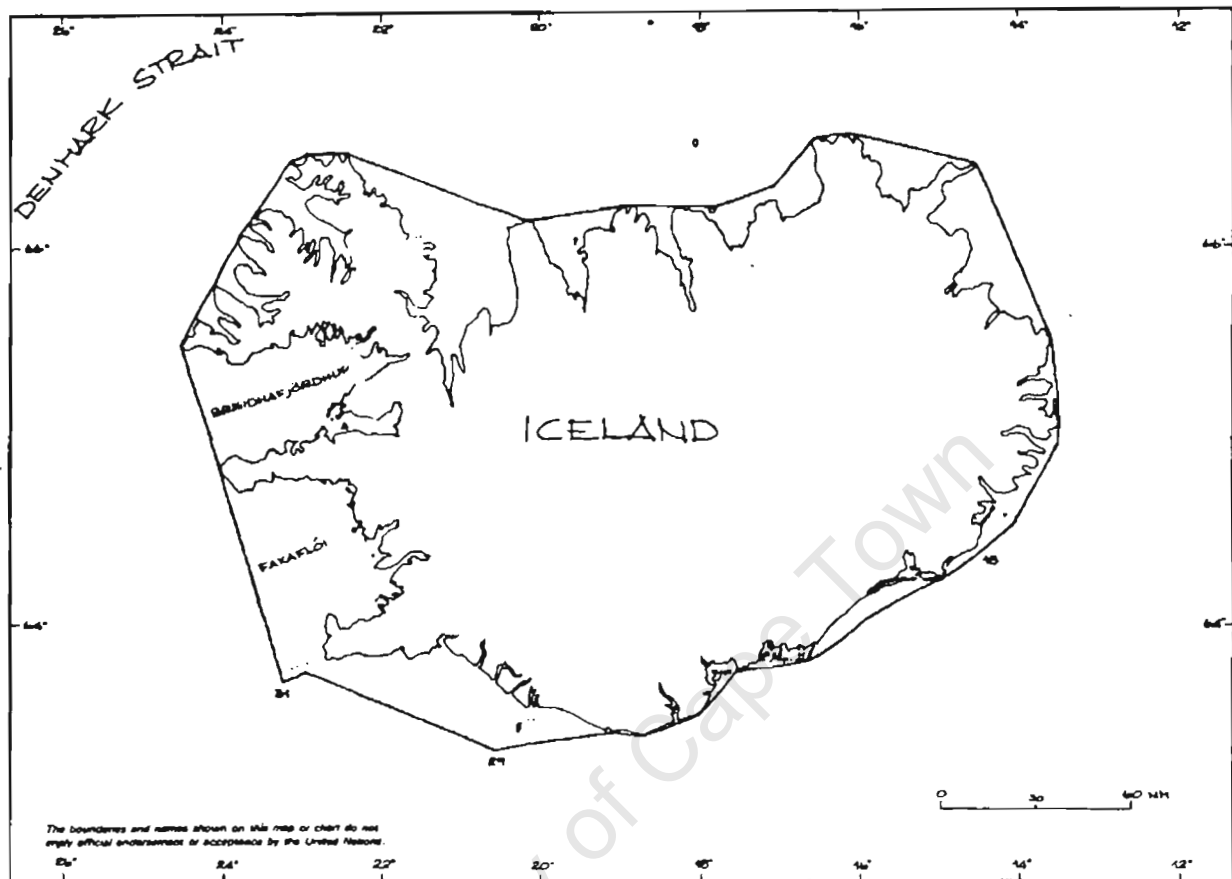


Figure 46 STRAIGHT BASELINES DRAWN ON A DEEPLY INDENTED COASTLINE

b) where there is a fringe of islands along the coast in its immediate vicinity.<sup>708</sup>

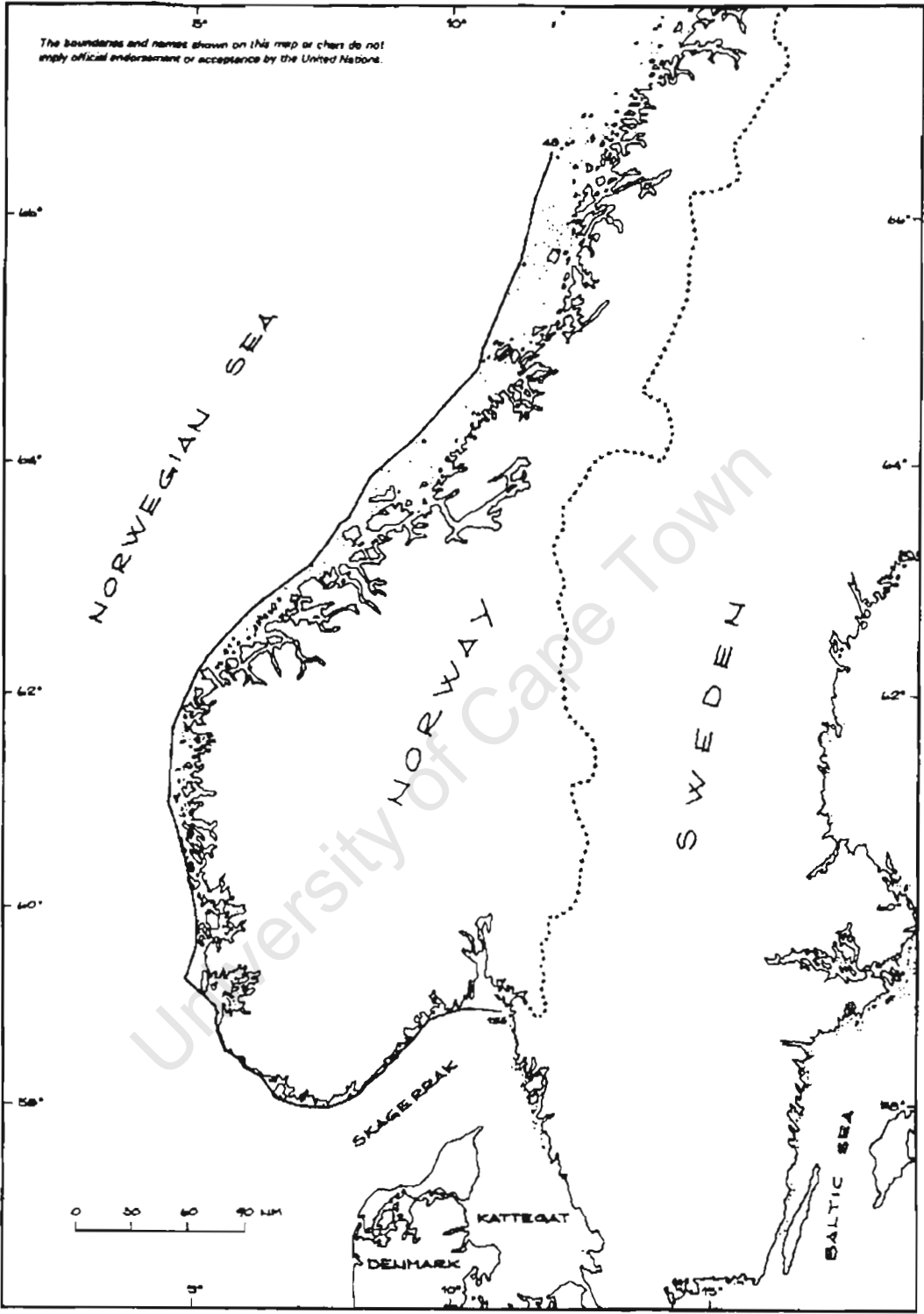


Figure 47      STRAIGHT BASELINES DRAWN TO FRINGING ISLANDS

<sup>708</sup> ibid

c) where there is delta or other natural conditions which cause highly unstable coastline conditions,<sup>709</sup>



Figure 48 THE MISSISSIPPI DELTA

(Lobes avulse every few hundred years and it is possible to record this by a comparison with old data)

<sup>709</sup> LOSC Article 7(2)

c) Where a State qualifies in terms of LOSC as an archipelagic State.<sup>710</sup>

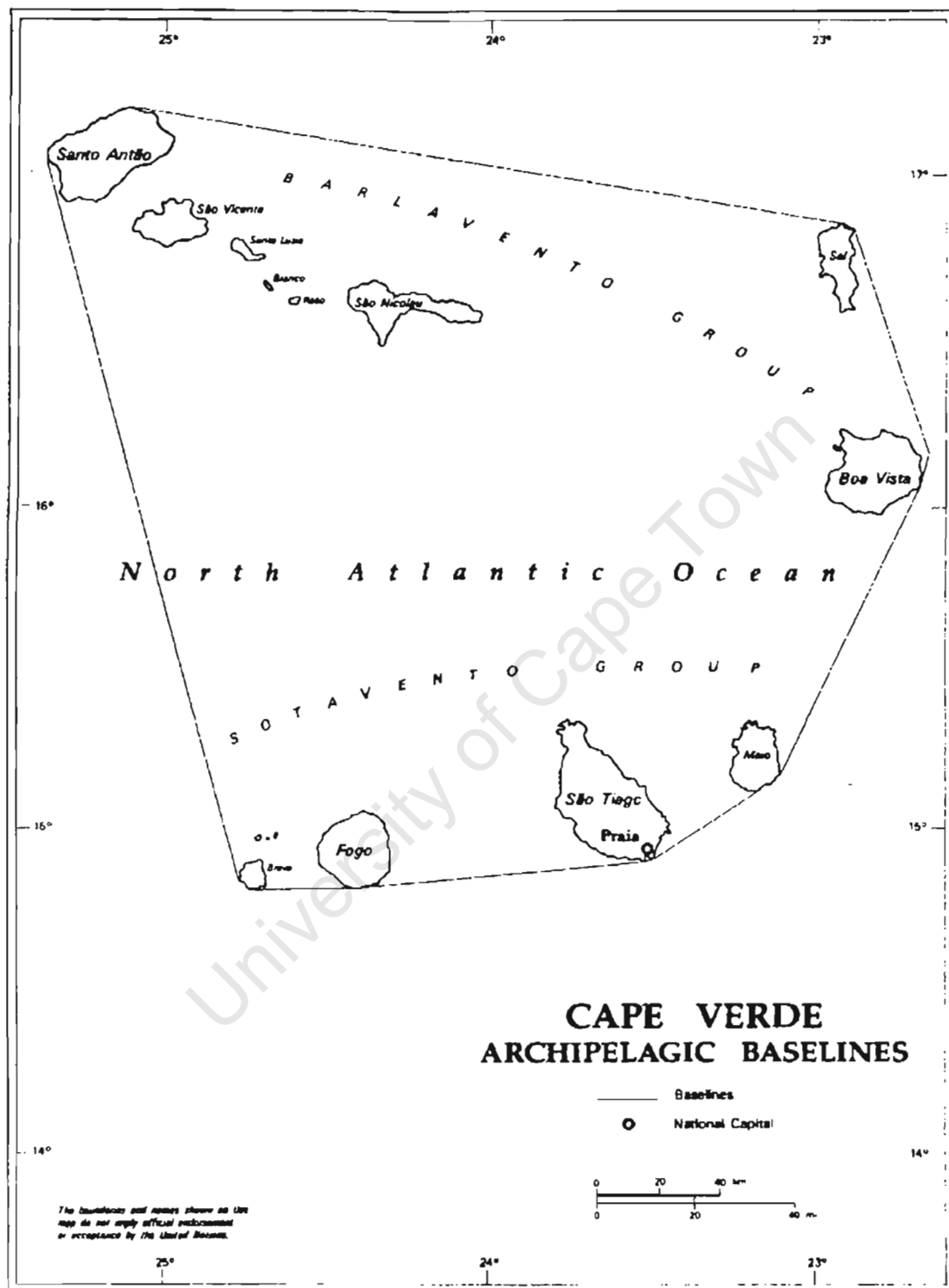


Figure 49 ARCHIPELAGIC BASELINES DRAWN AROUND THE CAPE VERDE ISLANDS

<sup>710</sup> LOSC Article 46



Straight baselines may be drawn to the low-water line on the coastline or on islands and to low-tide elevations where they have lighthouses or structures built on them and are permanently above high tide.<sup>711</sup> They may not be drawn to other artificial structures on the seabed.<sup>712</sup>

The United States has developed criteria which they feel should be the basis on which the implementation of straight baselines may be evaluated.<sup>713</sup> This is United States State practice and does not necessarily reflect international law. It serves only as a guide for States drawing straight baselines, and other States evaluating them. A review of the practice of States in regard to the adoption of straight baselines indicates that a variety of geographical criteria have been utilised in the process.<sup>714</sup> Many baselines adopted by coastal States are at variance with the criteria adopted by the US.<sup>715</sup>

### Unstable Deltas.

The outer limits of a delta are governed by the transportation of sediments into the area and by the erosion of the delta by the action of the river, wave action and the currents prevalent in the area. This could lead to a highly unstable area of the coast where the outer limit would accrete seawards on occasions and, similarly, would be eroded landwards on other occasions. In some areas deltaic progradation is so rapid that it can be measured during human time-scales. To provide stability to the territory claimed, a coastal State may fix the outermost points where the low-water line of the delta recedes and should the regress landwards the position of the outer points will remain until the coastal State amends them in accordance with the LOSC.<sup>716</sup>

### Bays.

The closing of bays with straight lines has been treated separately in LOSC. Bays that meet certain geographical criteria may be closed by drawing a straight line across the mouth of the bay from low-water line to low-water line at the natural entry points of the bay.

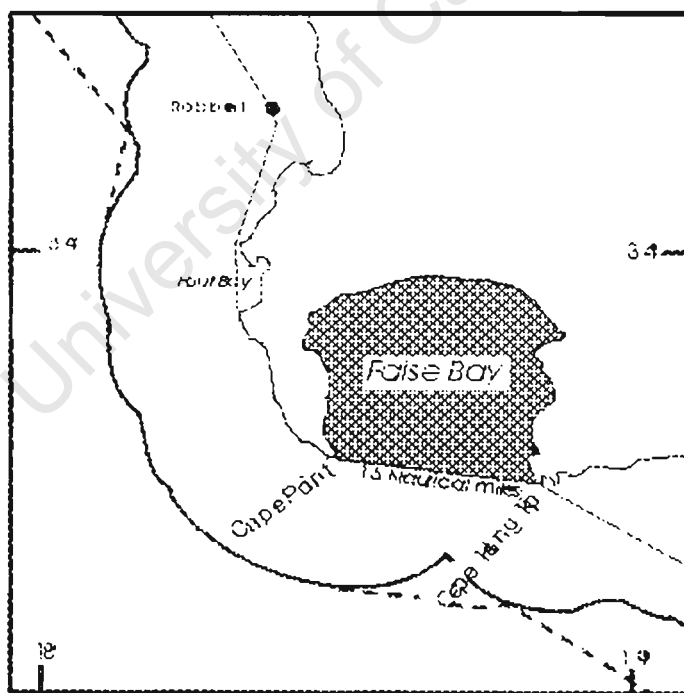


Figure 50 LINE CLOSING FALSE BAY

<sup>711</sup> LOSC Article 7(4)

<sup>712</sup> LOSC Article 60(8)

<sup>713</sup> Limits in the Seas n693

<sup>714</sup> ibid p1

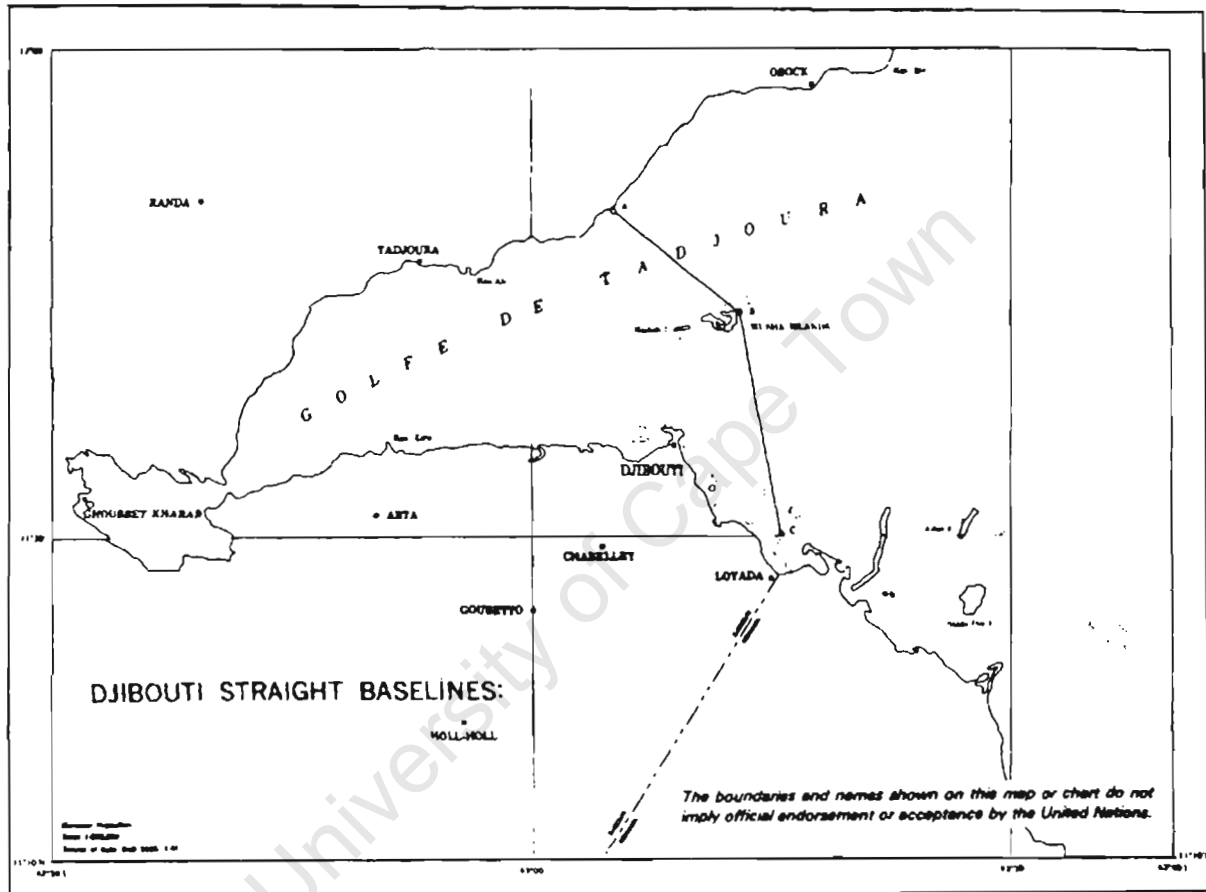
<sup>715</sup> Scovazzi n46

<sup>716</sup> LOSC Article 7(2)

The criteria are as follows;

- a) the bay must belong exclusively to one State;<sup>717</sup>
- b) the straight line may not exceed 24 nm in length;<sup>718</sup>
- c) The area of the water enclosed within the closing line must be at least equal to the area of the semi-circle subtended by the closing line.<sup>719</sup>

Should the distance between the natural entry points of the bay exceed 24 nm, lines further up the bay maybe considered until the criteria are met.<sup>720</sup>



**Figure 51 BAY-CLOSING LINES WHEN THERE ARE ISLANDS IN THE MOUTH OF THE BAY**

Islands in the bay or in the mouth of the bay have an effect on the consideration of whether the bay complies with the above criteria.

<sup>717</sup> LOSC Article 10(1)

<sup>718</sup> LOSC Article 10(5)

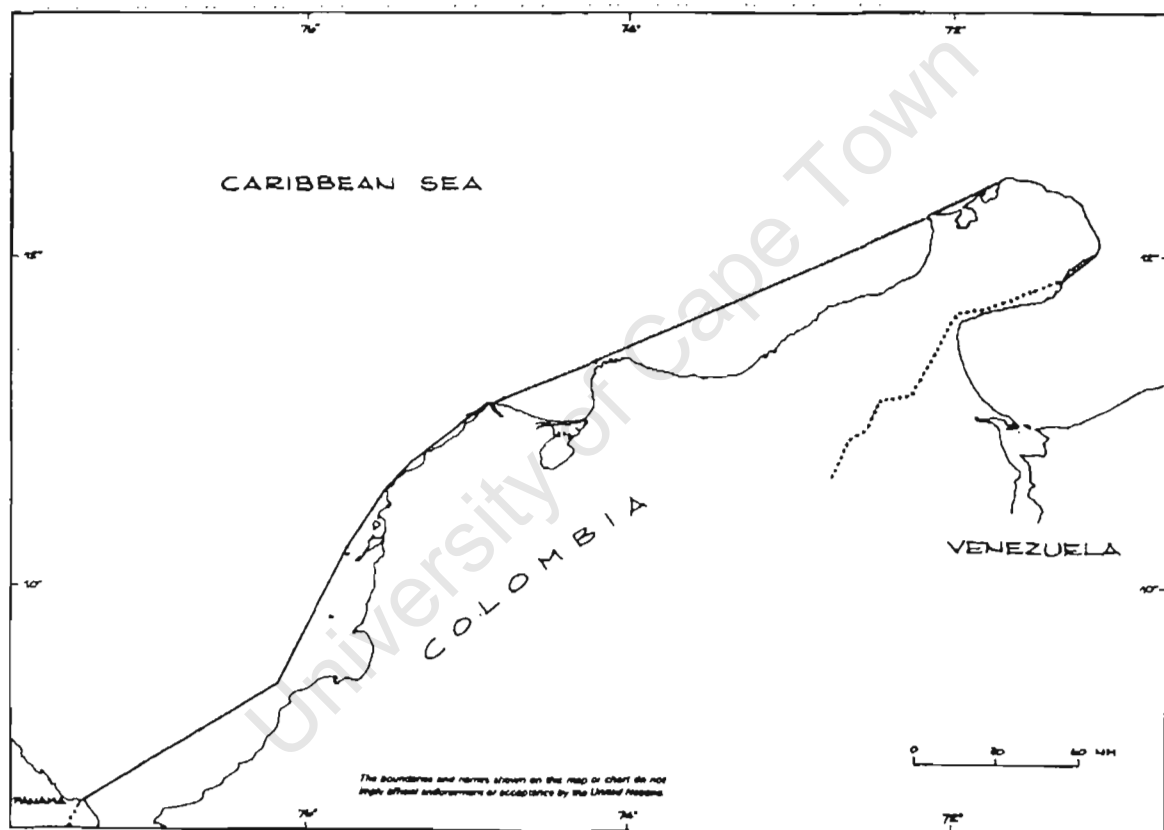
<sup>719</sup> LOSC Article 10(2)

<sup>720</sup> LOSC Article 10 (5)

Where, as a result of the presence of islands in the mouth of the bay, the bay has more than one entrance, the sum of the baselines drawn to the low-water lines of these islands is used to establish the size of the area of the semi-circle and the length of the line. If the bay meets the above requirements these lines may be used as the closing lines.

The portion of the bay that is measured when the area requirement is considered, is that area between the low-water mark in the bay and the line closing the bay. Any island situated in the bay is considered as water for the purpose of the calculations.<sup>721</sup>

It appears that many States have closed bays that are not in accordance with the requirements of Article 10. The lines closing bays as drawn by the following States Albania, Algeria, Australia, Cameroon, Colombia, Dominican Republic, Ecuador, Haiti, Indonesia, Italy, Kenya, Madagascar, Morocco, Portugal, Senegal, and Spain and shown in Scovazzi may not comply.<sup>722</sup>



**Figure 52 BASELINES THAT DO NOT MEET THE REQUIREMENTS FOR EITHER STRAIGHT BASELINES OR THE CLOSING OF A BAY**

It may be argued that these baselines do not close bays but are straight baselines. An examination of the coastline will show that this can be seriously disputed in most cases.

<sup>721</sup> LOSC Article 10(3), MP Strohl The International Law of Bays (1963)

<sup>722</sup> Scovazzi n46

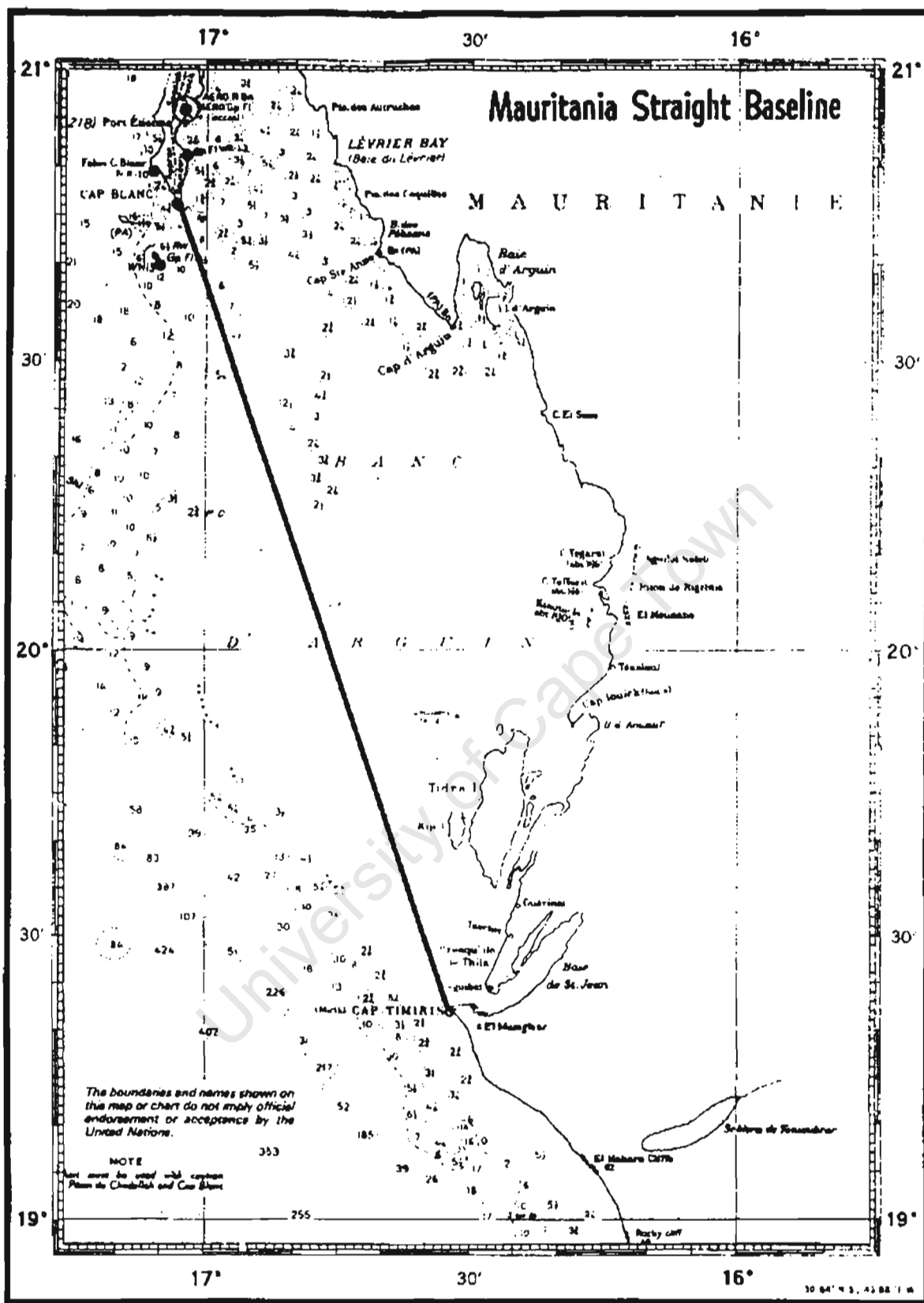


Figure 53 THE MAURITIAN STRAIGHT BASELINE FROM WHICH THE TERRITORIAL SEA IS MEASURED  
(It is in excess of 80nm)

- b) The distance between the islands and the coast should be a consideration.<sup>748</sup>

An actual distance is not recommended but Prescott<sup>749</sup> states as follows:

*Probably everyone would agree that a fringe of islands 3 nm from the coast was in the immediate vicinity. Equally everyone would probably agree that a fringe of islands 100nm from the coast was outside its immediate vicinity. Unfortunately, it would not be possible to predict with confidence what the majority thought of a fringe of islands 25,40 or 65 nm from the coast.*

To accept a maximum distance of 24 nm of the islands from the coast would not benefit the coastal State on the landward side of these islands. The 12 nm territorial sea from the coast and a 12 nm territorial sea from the inner baseline of the islands would effectively create territorial waters over the entire area and would restrict the activities of foreign vessels anyway. The main advantage would be found in the status of the waters enclosed by the baselines drawn on the seaward side of fringing islands.

These waters would be internal waters and not territorial sea. If the straight baselines were not drawn, the mainland would be entitled to 12 nm of territorial sea and an additional 12 nm as contiguous zone. This would be the same for the fringing island. If there was less than 24 nm between the islands and the mainland, then there would be little gain to the State by drawing straight baselines. An argument, therefore, that an acceptable distance for fringing islands to be from the coast of the mainland would be 24 nm is considered reasonable.

- c) Islands included in the fringe should not be more than 24 nm apart.<sup>750</sup>

The same argument used to derive the maximum distance between a fringe of islands and the mainland is used to determine an optimum distance between islands for them to be connected by baselines. As no length is laid down in LOSC, coastal States will exercise their right to their best advantage regardless of this recommended maximum distance.

- d) The fringing islands should mask 50% of the adjacent coastline off which they lie.<sup>751</sup>

The US argument in drafting this criterion is to establish whether the islands are truly fringing. Various opinions have been expressed<sup>752</sup> as to the definition of fringing. As some of the other factors concerning baselines have not been defined in LOSC and State practice in this regard is varied, the opinions expressed and the definitions offered are only speculative.

- e) No single baseline may exceed 48 nm.<sup>753</sup>

All these recommendations may have merit, but they have not been widely accepted and should therefore be considered only as a guide to what is perhaps internationally desirable. It is not known how extensively these criteria are applied, but it is submitted that, when gauging the practice of States,<sup>754</sup> very few States have followed the practice of the US or their recommendations. The territorial seas, the contiguous zone and the exclusive economic zone are measured from the baselines and with these baselines the State may enclose internal waters.

<sup>748</sup> ibid

<sup>749</sup> JRV Prescott Straight Baselines: Theory and Practice, (1985) p4

<sup>750</sup> Limits in the Seas n693 p17

<sup>751</sup> ibid

<sup>752</sup> Hodgeson n723 p7-10

<sup>753</sup> Limits in the Seas n693 p17

<sup>754</sup> T Scovazzi "Coastal State Practice in the Exclusive Economic Zone: The Right of Foreign States to Use This Zone" TA Clingan (Jnr) The Law of the Sea: What Lies Ahead Proceedings of the 20th Annual Conference of the Law of the Sea Institute, Miami (1986) p311

## Internal Waters

Internal waters are waters landwards of the baselines of a coastal State.<sup>755</sup>

## Territorial Sea

*A belt of water of a defined breadth but not exceeding 12 nautical miles measured seaward from the territorial sea baseline.*

*The outer limit of the territorial sea is the line every point of which is at a distance from the nearest point of the baseline equal to the breadth of the territorial sea.*

*Art. 12 provides that certain roadsteads wholly or partly outside the territorial sea are included in the territorial sea, no breadth limitation is expressed.*<sup>756</sup>

Territorial seas are the waters of a coastal State up to a maximum distance of 12 nm from the baselines of the State.<sup>757</sup> It is submitted that the determination of the outer limits of the territorial waters of a coastal State is singularly the most important delimitation for the State to undertake. Other than internal waters, territorial waters attribute most rights to a coastal State and the baselines from which these outer limits are determined are also used for the other zones.<sup>758</sup>

If a roadstead, which is used for the loading, unloading or anchoring of vessels, falls partly or wholly outside of the territorial sea of a coastal State it may be included in the territorial sea.<sup>759</sup>

## Contiguous Zone

The contiguous zone is located seaward of the territorial seas to a maximum of 24 nm from the baselines from which the outer limits of the territorial seas are measured.<sup>760</sup>

The outer limits of the contiguous zone are measured from the same baselines as the territorial sea and the inner boundary is the outer limit of that territorial sea. Laws dealing with particular aspects, such as immigration, emigration, customs and excise, sanitary and fiscal, may be enforced by the coastal state in these zones.<sup>761</sup> The enforcement of these laws will have to be carefully applied as freedom of navigation is a right in the exclusive economic zone of which this zone is a part.<sup>762</sup>

*In a zone contiguous to its territorial sea, described as the contiguous zone, the coastal State may exercise the control necessary to:*

- a) prevent infringement of its customs, fiscal, immigration or sanitary laws and regulations within its territory or territorial sea;*
- b) punish infringement of the above laws and regulations committed within its territory or territorial sea.*<sup>763</sup>

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<sup>755</sup> LOSC Article 8

<sup>756</sup> IHO n192 p27

<sup>757</sup> LOSC Article 3

<sup>758</sup> LOSC Article 33(2), and 57

<sup>759</sup> LOSC Article 12

<sup>760</sup> LOSC Article 33(2)

<sup>761</sup> LOSC Article 33(1)(a)

<sup>762</sup> LOSC Articles 33, 58 and 87

<sup>763</sup> IHO n192 p11

## Archipelagic Waters

The archipelagic baselines described earlier in this Chapter enclose archipelagic waters. The archipelagic State has sovereignty over these waters and the air space above it.<sup>764</sup> The archipelagic State is obligated to respect existing agreements, traditional fishing rights and other legitimate activities of neighbouring States in its archipelagic waters. The breadth of the territorial sea, contiguous zone and the exclusive economic zone are measured from the archipelagic baselines.<sup>765</sup>

## Maritime Cultural Zone

A maritime cultural zone has been included in the Maritime Zones Act. This allows South Africa the same rights and powers over objects of archaeological or historic importance found on the seabed in this area as in the territorial waters. As this zone is coincidental with the contiguous zones of South Africa the outer limits are jointly determined.<sup>766</sup>

## Exclusive Economic Zone

*The exclusive economic zone is a zone seawards of the territorial seas of a coastal State to a maximum of 200 nm from the baselines from which the outer limits of the territorial seas are measured.*<sup>767</sup>

The zone may not be extended beyond 200 nautical miles from the territorial sea baselines. The rights and jurisdiction of a coastal state in the exclusive economic zone are detailed in Article 59 of LOSC. Other aspects of the exclusive economic zone are to be found in Part 5 of the Convention.

The establishment of an internationally acceptable exclusive economic zone gives a coastal State the right to conduct research, explore, exploit, manage, and generally control all natural resources contained within the limits of the zone.

The outer limits of the zone are calculated from the baselines of the coastal State. As the maximum breadth of an exclusive economic zone is 200 nm the co-ordinates of the outer limits must be geodetically computed as discussed in Chapter IV. These co-ordinates must be shown on suitable charts of the coastal State and due publicity must be given to the charts or to the list of co-ordinates. The charts and co-ordinate list must also be deposited with the Secretary General of the UN.<sup>768</sup>

## LOSC Continental Shelf

Fortunately the marine-geological definition for the continental margin has been adopted in LOSC but the definition of the continental shelf, in LOSC, which is a component of the continental margin, has attained a specific connotation in LOSC. The geological shelf and margin are as indicated in Figure 55.

LOSC continental shelf delimitation is regarded as complicated and difficult to implement. The LOSC continental shelf adjoining a coastal State may be claimed in accordance with criteria listed in LOSC.<sup>769</sup> One of these criteria is a requirement for the outer limit to be less than 100 nm from the 2500 m isobath.

<sup>764</sup> JG Starke *Introduction to International Law* (10<sup>th</sup> Ed) (1989) p262, LOSC Article 49

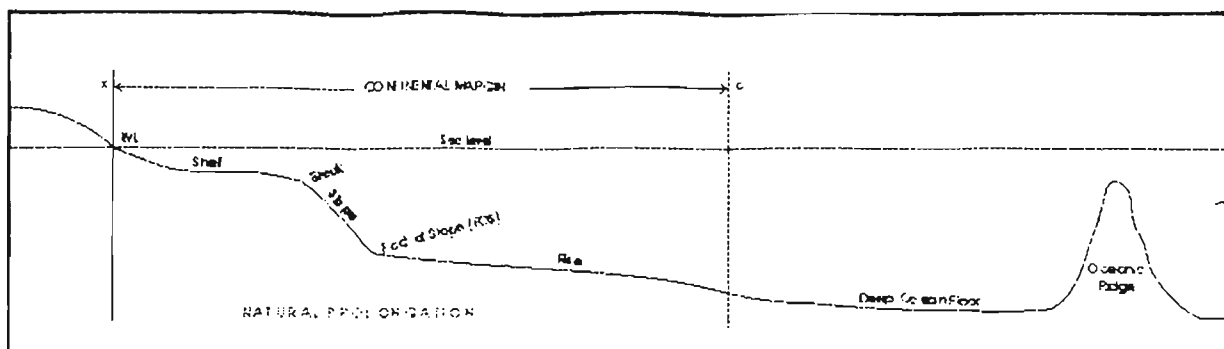
<sup>765</sup> LOSC Article 48

<sup>766</sup> Maritime Zones Act n690 Section 6(2)

<sup>767</sup> LOSC Article 57

<sup>768</sup> LOSC Article 75

<sup>769</sup> LOSC Article 76



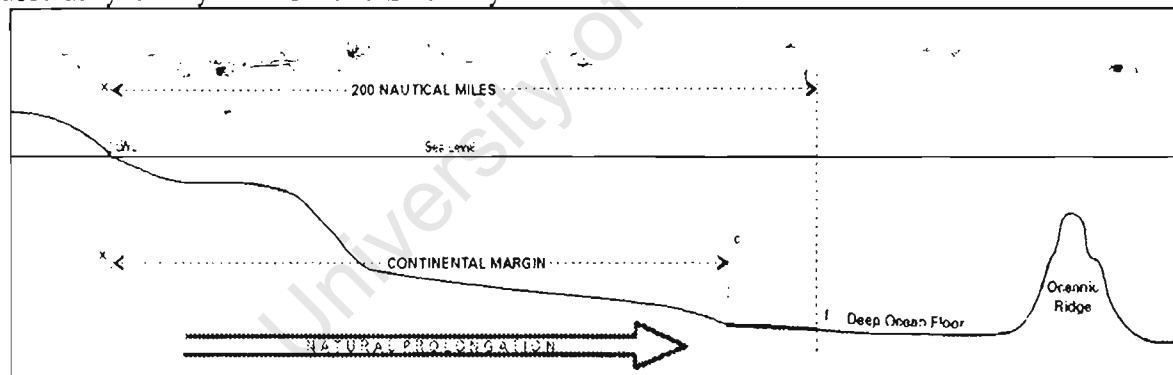
**Figure 55 THE CONTINENTAL MARGIN**

(Comprises the submerged prolongation of the land mass of the coastal State and consists of the seabed and subsoil of the shelf, the slope, and the rise : It does not include the deep ocean floor with its oceanic ridges or the subsoil thereof. (LOSC Article 76(3) )

xc represents the geological continental margin

A second requirement is that the outer limit must be less than 350 nm from the baselines from which the territorial sea is measured.<sup>770</sup> A coastal State may use whichever is the greater of these two criteria. Within these maximum limits, two additional criteria must be met for a claim to comply with LOSC. The outer limit must not be further seawards than either 60 nm from the foot of the slope or a position at which the sediment thickness is equivalent to 1% of the distance of that position from the foot of the slope, whichever is the greater.<sup>771</sup>

Seismic surveys to determine sediment thickness are expensive so the 2500 meter isobath and the configuration of the seabed in the region of the foot of the slope should therefore be accurately surveyed before seismic surveys are undertaken.



**Figure 56 THE MINIMUM CONTINENTAL SHELF THAT A COASTAL STATE IS ENTITLED TO CLAIM**

(If there are no overlapping claims, this is 200 nm from the baselines; This could therefore include portions of the deep ocean floor)

xc represents the geological continental margin

xf represents 200 nm from the baselines

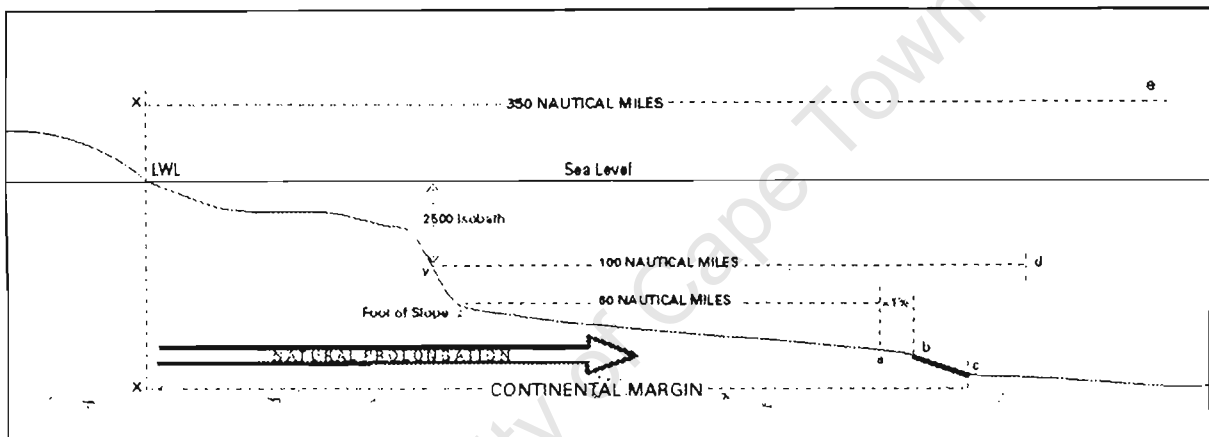
cf represents that portion of the deep ocean floor that would be included in the claim

<sup>770</sup> LOSC Article 76 (5)

<sup>771</sup> LOSC Article 76 (4)(a)(i)&(ii), GP Francalanchi "Geological Interpretation of Art 76 of the United Nations Convention on the Law of the Sea" *Proceedings of the TALOS Working Group Symposium* (May1990) p13-19



- a) if it can be reliably estimated that the outer limit, would fall within 200 nm of the baselines little purpose would be served by additional expensive surveys being undertaken as a coastal State may, in terms of its exclusive economic zone, claim the seabed to a maximum of 200 nm from its baselines without additional information being obtained;
- b) if it is considered that the location of the foot of the slope indicates that the required distances measured from it will extend beyond 200 nm then the foot of the slope should be accurately surveyed;
- c) if 60 nm from the foot of the slope reaches the greater of the distances of 100 nm from the 2500 metre isobath and 350 nm from the baselines then it is unnecessary to consider sediment thickness and seismic surveys need not be undertaken;
- d) Where 60 nm from the foot of the slope does not extend to the maximum allowed only then should seismic surveys be considered.



**Figure 57 THE OUTER LIMITS OF A CLAIM MAY NOT EXCEED 350nm FROM THE BASELINES OR 100nm FROM THE 2500m ISOBATH, WHICHEVER IS THE GREATER. (Within these criteria claims may be made to positions that are either 60 nm from the 'foot of the slope' or where the sediment thickness is equal to or greater than 1 % of the distance at that position to the 'foot of the slope')**

South African claims to the continental shelf could not be determined in accordance with Article 76(4)(a) of LOSC without extensive hydrographic and seismic surveys being undertaken. The maximum limits allowed in terms of Article 76(5) of LOSC have therefore been co-ordinated and appear as a Schedule to the Act. It is the intention of the RSA Government to conduct the necessary surveys to confirm or amend these claims, as soon as the data can be obtained.<sup>773</sup>

773 Minutes of Meeting of Department of Transport and SAN Hydrographic Office SANHO Ref Hyd  
327/1/3/Comm (May 1995)

## Submarine and Oceanic Ridges

An oceanic ridge is defined as follows:

*A long elevation of the deep ocean floor with either irregular or smooth topography and steep sides.*<sup>774</sup>

Oceanic ridges are usually found in the mid-ocean and are as a result of the extrusion of new lithospheric material from the outer mantle at the time of sea-floor spreading.<sup>775</sup> The deep-ocean floor with its oceanic ridges is excluded from an LOSC continental shelf,<sup>776</sup> unless they are located within 200 nm from the coast and the coastal State is able to claim the full 200 nm as LOSC continental shelf.<sup>777</sup>

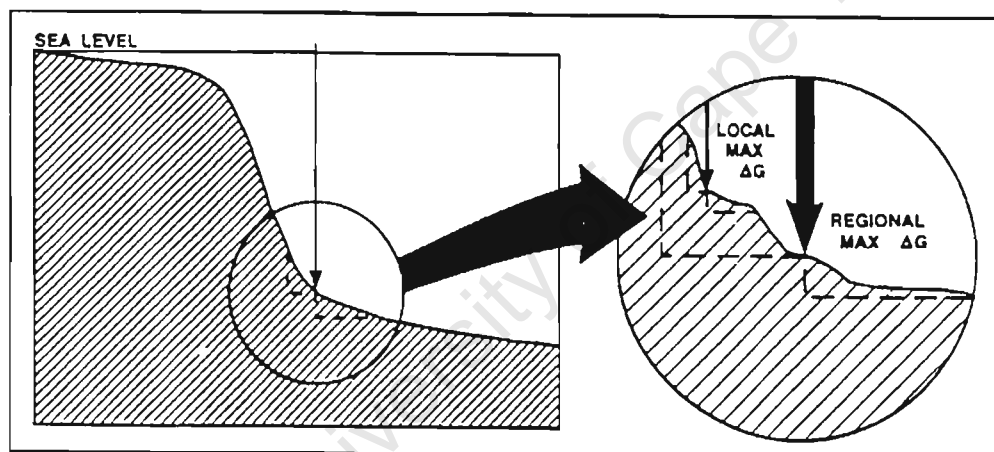
A submarine ridge is defined as follows:

*An elongation of the sea floor, with regular or relatively smooth topography and steep sides.*<sup>778</sup>

Submarine ridges could be a part of the continental margin of a coastal State. These ridges may be considered when an LOSC continental shelf is determined.<sup>779</sup>

## Determining the Position of the Foot of the Continental Slope

To establish the position of the foot of the slope for the determination of a LOSC continental shelf claim, the configuration of the seabed must be investigated over a relatively large area. The seabed could have a simple profile enabling an easy identification of the foot of the slope. It could equally be complex with multiple slopes and it is imperative that adequate surveys be undertaken before any assumptions are made. These surveys could be both bathymetric and seismic.



*The foot of the continental slope is defined as the location of the maximum change on bottom gradient. As shown in the enlarged section, this location may vary according to the range over which the gradient is calculated, i.e. the feature may be determined on a local basis (thin arrow) or a regional basis (thick arrow).*

**Figure 58 THE COMPLEXITIES OF IDENTIFYING THE POSITION OF THE 'FOOT OF THE SLOPE'**

Seismic surveys have accuracies that are not comparable with those of the methods used in the surveys of other disciplines. The position of the foot could be complicated by virtue of the fact that more than one position can be identified. The criterion that must be met is that the foot of the slope is the position where the maximum change in gradient at the bottom of the slope occurs. Geodesists have

<sup>774</sup> IHO n192 p21

<sup>775</sup> Kennett n383 p30

<sup>776</sup> LOSC Article 76(3)

<sup>777</sup> LOSC Article 76(1)

<sup>778</sup> IHO n192 p27

<sup>779</sup> LOSC Article 76(6)

calculated the possible horizontal error that could occur with various levels of data density and the positions of the foot of the continental slope between observations are interpolated.<sup>780</sup>

This process is described as follows:

*We use a regular grid with varying interval to sample surfaces . Then we construct the maximum curvature surfaces with these sample data and trace ridges on these discrete surfaces by the algorithm we have developed. One of the ridges corresponds to the foot line with the theoretically correct footline to evaluate accuracy. Two norms, N1 and N2, are used to measure the accuracy. The N1 is the area enclosed by the two lines whose closeness we are trying to measure. The N2 is the discrete quadratic norm or the mean square deviation.*<sup>781</sup>

Three different depths of the continental slope were used in these calculations, 4, 6 and 8 km and three different values of the continental slope gradient were also used. There were 210 samples for each data density and an average accuracy of footline determination by the algorithm, and its 95% confidence level, were obtained.

A “Rule of Thumb” formula was found that;

*the root mean square error of footline determination is one third of the data interval and a real error is approximately 23 km square / 100 km per one kilometre data interval.*

An algorithm to gauge the effectiveness of the determination of the footline was devised, which is the line at the foot of the slope, in relation to the density of the data available.

Three different cases were considered as follows:

- a) different shapes of the sea bottom;
- b) different depths of the continental shelf;
- c) different gradients of continental slope.<sup>782</sup>

### **Foot of the Continental Slope in a Passive Margin**

Passive margins are distinguishable by relatively small geological, bathymetric and geophysical changes from the continent to the deep ocean floor. Some passive margins, such as the one north of San Francisco Bay California, have simple almost monotonous configurations where it is relatively easy to identify a foot of the slope.<sup>783</sup>

### **Foot of the Continental Slope in an Active Margin**

Active margins, such as on the Pacific Rim, have relative velocities that could be of the order of 10 cm per year. With the crusts converging, and one of the crusts being subducted in a trench, the boundary between the crusts is easily identified. As a result of the frictional heat generated by these activities large masses of igneous material are formed. This erupts as lava and forms an extensive chain of islands on the inner side of the trench. This creates an arc of islands, surface or submarine, around the continent or island and complicates the identification of the foot of the slope. It also makes it extremely difficult to establish the extent of sediment thickness on any rise that may be present. It is

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<sup>780</sup> Ou n612 p1

<sup>781</sup> ibid

<sup>782</sup> P Vanicek & Z Ou The Effect of Data Density on the Accuracy of Foot-Line Determination through Maximum Curvature Surface by Automatic Ridge-Tracing Algorithm: University of New Brunswick (1996) p1

<sup>783</sup> Shalowitz 1 n116 p185

also difficult to distinguish between the ocean floor with its oceanic ridges and the continental slope with a trench and surrounding volcanic islands.<sup>784</sup> This is not relevant to the South African situation.

### Outer Limit

*The extent to which a coastal State claims or may claim a specific jurisdiction in accordance with the provisions of the Convention.* -

*In the case of the territorial sea, the contiguous zone and the exclusive economic zone, the outer limits lie at a distance from the nearest point of the territorial sea baseline equal to the breadth of the zone of jurisdiction being measured.*

*In the case of the continental shelf, where the continental margin extends beyond 200 nautical miles from the baseline from which the territorial sea is measured, the extent of the outer limit is described in detail in Article 76.*<sup>785</sup>

All maritime zones, with the exception of an LOSC continental shelf and territorial sea roadsteads, are distances measured from the baselines of the coastal State. It is not practical to claim these zones and expect a master of a vessel to know where the outer limits of the zones are if co-ordinates are not provided by the coastal State. These values should be given due publicity as in the case of the outer limits of the continental shelf.<sup>786</sup>

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<sup>784</sup> T Sato & S Oshima "Continental Shelf Survey Project of Japan" IHR LXV(1)( January 1988) p41-55

<sup>785</sup> IHO n192 p21

<sup>786</sup> LOSC Articles 16, 75(1) & 84

University of Cape Town

## METHODS OF DELIMITING LATERAL AND MEDIAN LINE BOUNDARIES.

### Equidistance

The equidistant method of delimitation requires that any position on a boundary line, that is either a lateral boundary for adjacent States or a median line for opposites, must be equidistant to the nearest points on the baselines of the States concerned.<sup>787</sup>

Although this principle appears to be relatively simple great care should be taken in the conduct of survey operations and the adoption of baselines and datums.

Geodetic considerations have been referred to in Chapter IV and they are germane to any survey operation. The determination of the positions of the baselines on the coast are particularly significant as the equidistant line, which is generated from these baselines, could extend seawards many times the distance between these base points. This would magnify any error in the baselines.

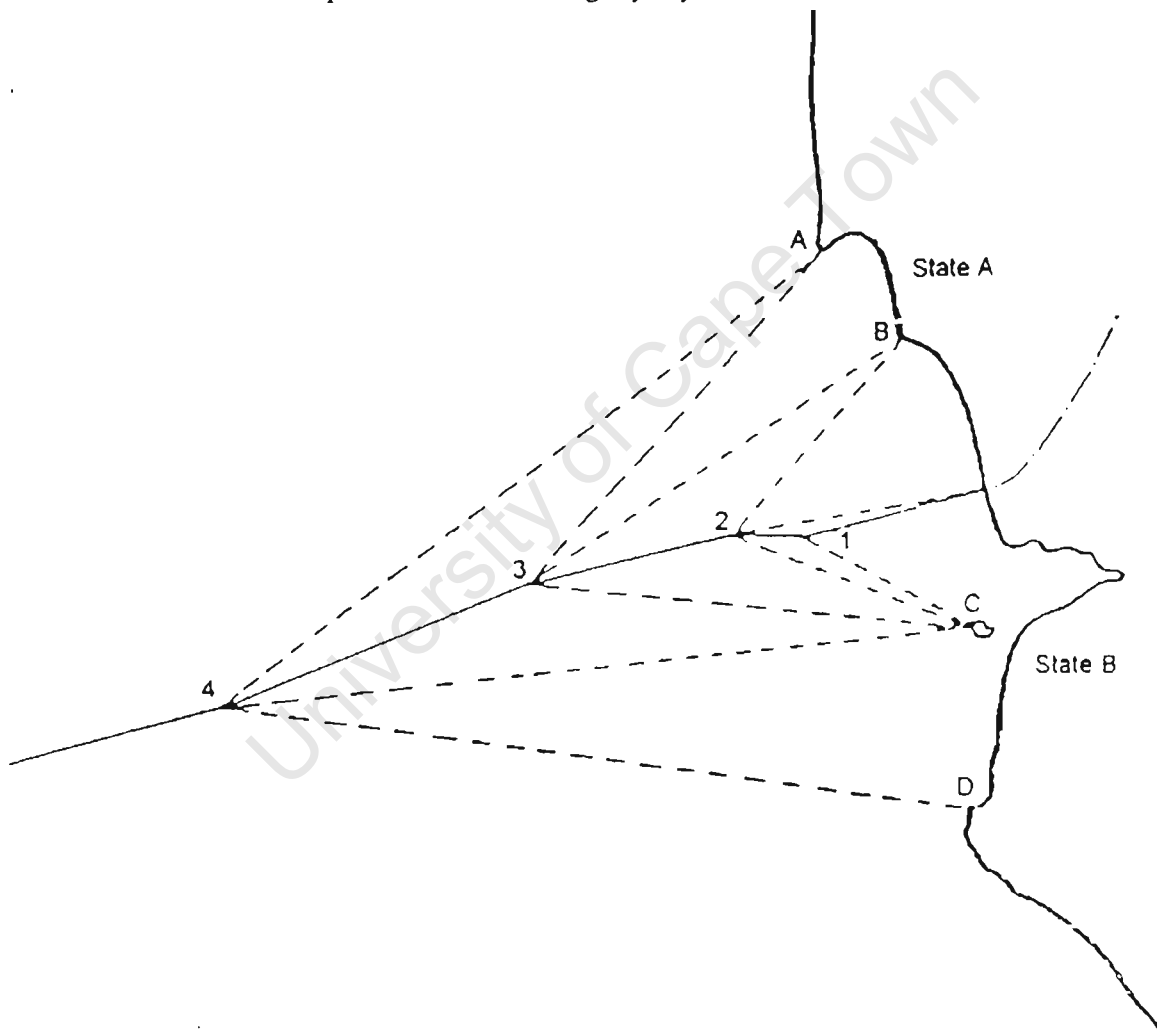


Figure 59 THE EQUIDISTANT METHOD OF DETERMINING A LATERAL BOUNDARY BETWEEN STATES

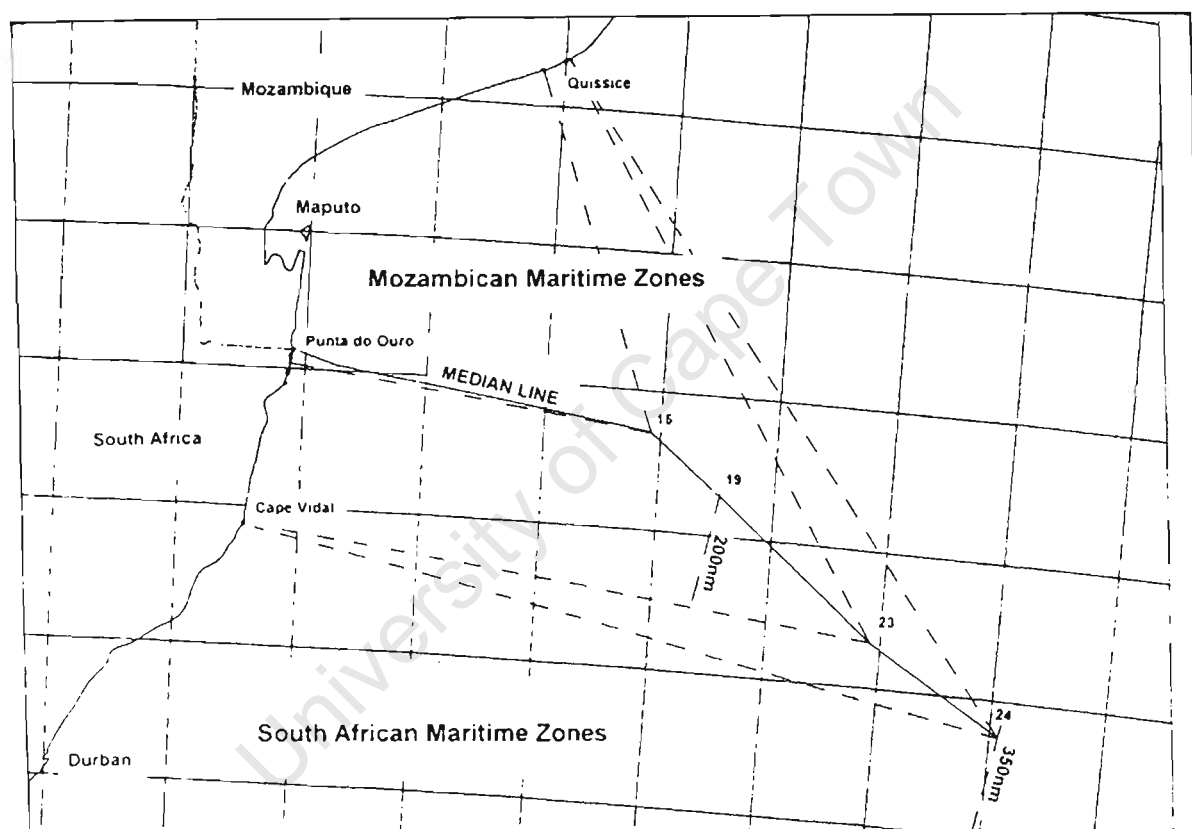
(Each position on the boundary must be equidistant from the nearest points on the coasts of the States concerned)

<sup>787</sup> LOSC Article 15

Some of the effects of determining the position of the low-water line have been considered in Chapter V. The determination of the low-water line, in an area where there is a large tidal range could result in marked differences in the horizontal positions adopted, if these were done at varying heights of tide.

The positions on the low-water line and the boundary line should be geodetically computed. The following determination indicates what the effect of even an error of three metres in tidal height adoption could be with careful consideration being given to the positioning of the low water line.

The equidistance line boundary between the RSA and Mozambique was determined jointly by the relevant technical authorities of the two States, but no agreement has been entered into in regard to this boundary as yet.<sup>788</sup> The line was generated from prominent features north and south of the terminal of the land boundary. This is a relatively short baseline and the effect of possibly incorrect positions of the low water line being adopted could have a significant effect when generated to 200nm and 350nm.



**Figure 60 THE MEDIAN LINE BOUNDARY CALCULATED BETWEEN SOUTH AFRICA AND MOZAMBIQUE USING THE EQUIDISTANT METHOD.**  
(This has not been ratified)

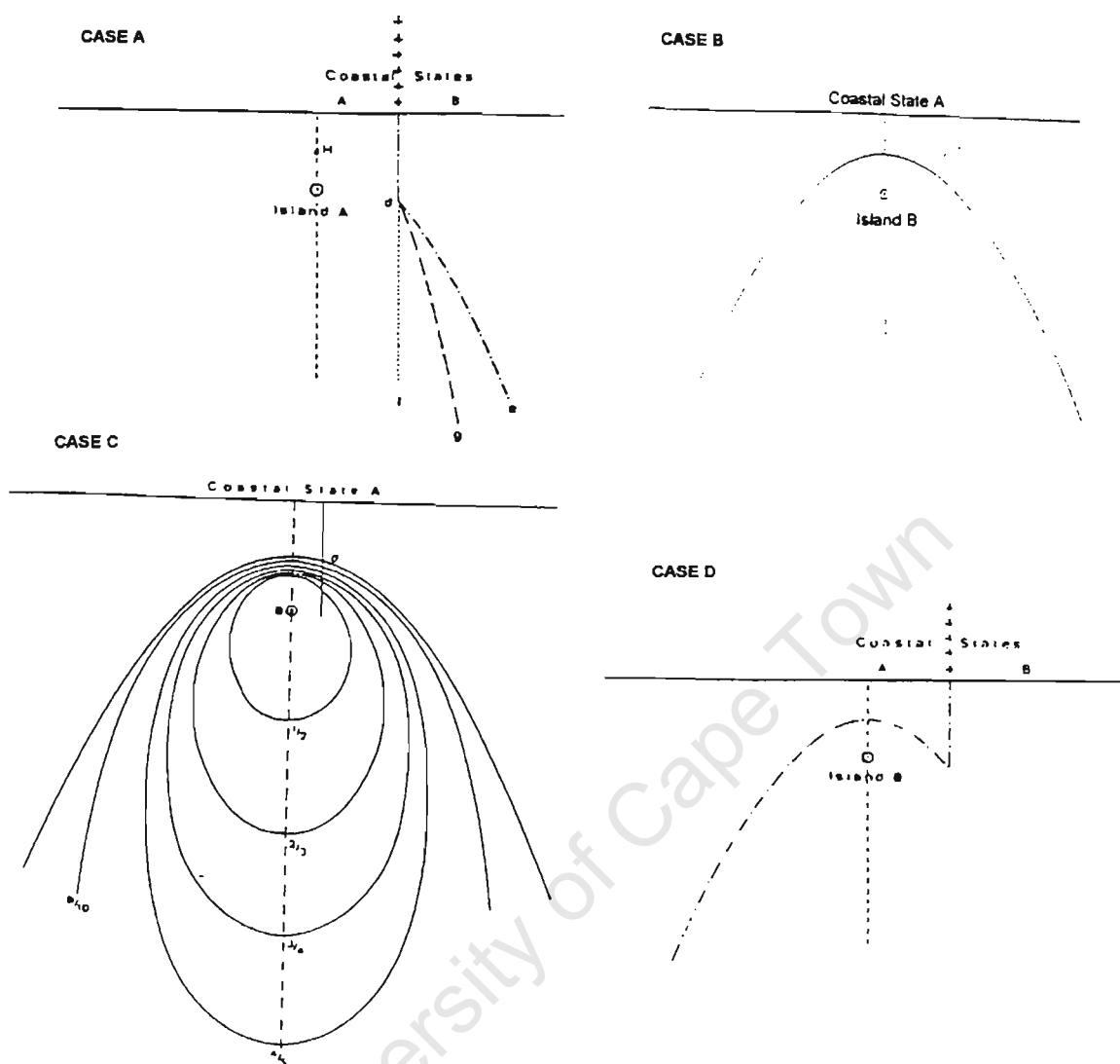
### Equiratio

As the emphasis in maritime delimitation has varied between equidistance and equity and as the concavity of a coastline can lead to an inequitable delimitation using of the equidistance method other methods have been advocated. The equiratio method is one of the alternatives and was advocated by Langeraar.<sup>789</sup>

<sup>788</sup> SAN HO n733 encl 191

<sup>789</sup> W Langeraar "Equitable Apportionment of Maritime Areas through the Equiratio Method" The Hydrographic Journal No 36 (April 1985)

Examples of the effect of an offshore island on a lateral boundary could be as follows:



**Figure 61 THE EFFECT OF THE POSITION OF AN ISLAND OFF THE COAST ON THE DETERMINATION OF A MEDIAN LINE**  
(Case C indicates the result if the 'Equiratio' Method is used)

In Figure 61 Case A one of the littoral States has an island marked A which exerts an influence on the determination of the medium line.

Case B indicates the boundary generated, by equidistance, between an island of State B close to the coast of another State A.

Case C indicates the same situation as Case B where the Equiratio method has been applied. The ratio of the distances in the figure results in the ever increasing hyperbola that extends seawards. The island generates an inequitable extent of maritime zones. Langeraar points out however if the ratio was not taken as 1:1 but 9:10, 4:5, 3:4, or similar ratios, then the hyperbola would become an ellipse and the area generated by the island could be regulated to an equitable extent.

Case D is where an island of a littoral State B is close off the shore of the coast of adjoining State A and the equidistance method has been utilised.



### **Lines of Azimuth**

A simplistic approach would be to adopt a line of bearing seawards from the terminal of a land boundary. In theory this should simplify the delimitation but in fact, for geodetic reasons, the line of azimuth is not a straight line regardless of its appearance on some charts. This creates a problem of application particularly where the line is extended to 200 nm from the coast and beyond.

### **Lines of Latitude**

To adopt a line of latitude as the boundary between two States would also initially appear to be a simple solution similar to the adoption of a line of azimuth. One of the problems is that the landward end of the maritime boundary must be coincident with the terminal of the land boundary. This presupposes that the land boundary terminal has been accurately determined and that the latitude of this terminal is of a value that could easily be applied for navigational and enforcement purposes. The latitude value of the land terminal effects the maritime boundary in that the latitude value of the entire boundary out to the limit of the continental shelf claim will be that of the land terminal. As it is extremely unlikely that the latitude of the terminal of the land boundary would fall conveniently on a value that is a whole number, it is likely that the line of latitude adopted for this terminal will have to be given in degrees, minutes, seconds, and, possibly decimals of a second.

### **Data Sources.**

Most Hydrographic Offices of coastal States have conducted extensive surveys on the continental shelf. These surveys have been specifically conducted to produce charts for the use of mariners. As such, as discussed in Chapter VII the data cannot always be used to satisfy other requirements. The coverage of this data is usually to a depth of 200 metres. Deeper surveys, in terms of the GEBCO Programme, have also been discussed in Chapter VII and could be used for reconnaissance purposes. It is clear that surveys would have to be conducted in specific areas to be able to determine the configuration of the continental margin in the areas necessary to substantiate claims made in accordance with the Articles of LOSC.

In Africa there are thirty four coastal States of which only five are members of the IHO. Until recently only one, the RSA, is capable of surveying beyond their ports and approaches to these ports. Mozambique, which has recently become a member State of the IHO during 1997, has now a fledgling hydrographic service which is supported with technical assistance from other States and is capable of conducting coastal surveys.<sup>790</sup>

The LOSC requirement therefore that an African coastal State depict its outer limits on a chart would depend on the availability of suitable data to produce up to date charts. Charts would more than likely have to be resurveyed and reproduced specifically for the delimitation. This could be beyond the financial capability of many African States.<sup>791</sup>

### **Some Problems in Delimitation and Possible Solutions**

#### **Caribbean**

The Caribbean is unique in the complexity of the geographical positions of the islands in relationship to one another and to the South American continent. An example is the relationship of the islands of Cuba, Haiti, and the Dominican Republic and Venezuela on the South American continent. There are also, in areas, considerable deposits of offshore and onshore oil and gas. The living marine resources are also relatively extensive.<sup>792</sup>

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<sup>790</sup> Proceedings of the Maputo Conference on Regional Co-operation in Hydrography Aids to Navigation and Other Services for the Safety of Navigation in Southern Africa (April 1995) p53

<sup>791</sup> *ibid*

<sup>792</sup> P Done "Maritime Boundary Legislation in the Commonwealth Caribbean" The Hydrographic Journal No 48 (April 1988) p17-23

Some of the States, such as Trinidad and Tobago, Antigua, Barbuda and Grenada have drawn archipelagic baselines. Others, such as Barbados, St Lucia and the Cayman Islands, have drawn a series of straight baselines. Belize, Turks and Caicos Islands and the Bahamas have done very little in regard to the maritime delimitation of their offshore areas. Some of the islands are able to comply with the requirements to claim a LOSC continental shelf, but it would appear that, at this stage, the complicated delimitation in the area is not being co-ordinated.<sup>793</sup>

*Where there are intricate geographical circumstances, the time needed for delimitation generally tends to be longer, Other complicating factors include the assertion of historic rights over certain parts of the undelimited area, and islands, particularly when it is unclear whether they should be considered habitable.*<sup>794</sup>

### **Namibia/Angola**

An interesting case<sup>795</sup> concerning the lateral boundary between Namibia and Angola was heard in November 1992 before Frank J in the High Court of Namibia..

Three Spanish fishing vessels were arrested for fishing in Namibian waters without licences. The accused contended that they were operating within licences issued by the Angolan authorities and had been fishing in the exclusive fishing zone of Angola within the limits contained in these licences.

Counsel for the Namibian Government claimed that a Namibian Cabinet decision had altered the lateral boundary between the States and that the accused were in the Namibian exclusive economic zone and, therefore, under the jurisdiction of Namibia. It would appear that the only Cabinet decision taken was to appoint a technical committee to redefine the boundary with Angola.<sup>796</sup>

This committee decided to calculate an equidistance line without taking into consideration the Peninsula of Dos Tigros situated on the Angolan coast. Their reasoning for this unilateral decision to exclude a non-contentious substantial portion of the Angola coastline is not recorded. When the Court required the State to substantiate the boundary, eight different borders were submitted.<sup>797</sup> Four of these boundaries overlapped the territorial sea of Angola, two appeared to extend the northern border of Namibia arbitrarily, and one attempted to extend the northern border 200 nm westward by the equidistance method. The last boundary was adopted as the 17 degree 15 minute South line of latitude from 12 nm to 200 nm. None of these boundaries were agreed to by Angola and negotiations were still in progress when the incident occurred. No publicity could be, or was therefore, given to them. The effect of the decision to exclude Dos Tigros from the calculations was to move the lateral boundary, as accepted by both States at the time, in a northerly direction.<sup>798</sup>

Numerous arguments were advanced as to the wording contained in some of the State papers submitted to the Court and what was meant by them. The authority of the Government of Namibia, the Cabinet and the mandate of the Technical Committee to act in the way they did was considered. While these arguments may be of direct concern to the case, it is of interest to note that the Court simplified the result and held that no decision was taken by the State of Namibia to change its border unilaterally. As it could not be shown, therefore, that the vessels were in the Namibian exclusive economic zone, they were not subject to the jurisdiction of the Court.

The relevant factors were as follows;

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<sup>793</sup> *ibid*

<sup>794</sup> R Lagoni "Interim Measures Pending Maritime Delimitation Agreements" *AJIL* Vol 78 (1984)

<sup>795</sup> *State vs Carracelas, Curras, and Perez. NL* (1992)

<sup>796</sup> *ibid* p3 J1

<sup>797</sup> *ibid* p2 J2

<sup>798</sup> *ibid* p2 J2

- a) that the equidistance line chosen was contentious and had not been agreed to by Angola;
- b) the vessels were operating on licences issued in accordance with the boundary that was generally accepted at the time;
- c) no publicity had been given to any of the many boundaries under discussion, nor had warnings being promulgated that the boundary had or could change and
- d) no agreement with Angola was entered into on the conduct of the two States in regard to this boundary pending the resolution of the matter.

The Namibian arguments were not accepted by the Court.

### Japan (Okino-Tori-Shima)

Okino-Tori-Shima is an island situated 810 nm south of the Japanese Kii Peninsula. It is the southernmost island of the Japanese archipelago and it is being rapidly eroded away by the action of sea and weather. The only portions of the island, at present, that are above high tide, are two rocks that are between 20-30 centimetres high. To prevent the total erosion of the island the Japanese Government has spent in excess of US \$275 million in creating two large artificial concrete reefs around the remains. Should these portions be eroded away to the point where they are permanently below high tide, Japan anticipates that they would lose rights over an area in excess of 116 600 square nautical miles. Without access to the data on which this assessment was made it is difficult to comment.<sup>799</sup>

### South Africa

Prior to the enactment of the Maritime Zones Act<sup>800</sup> serious inconsistencies and omissions existed in the legislation demarcating the maritime zones of South Africa. It was necessary, therefore, to consider entirely new legislation incorporating the latest developments in the law of the sea. An example of these inconsistencies was that the Territorial Waters Act<sup>801</sup> originally claimed a 6 nm territorial sea and a 12 nm fishing zone. In addition certain special rights were claimed in the fishing zone and these rights are today synonymous with those of a contiguous zone.<sup>802</sup> By 1977, many of the acceptable proposals arising from the discussions of UNCLOS III were becoming State practice. Presumably as a result of this the Territorial Waters Act was amended as follows:

- a) The 6 nm territorial sea became 12 nm.
- b) The 12 nm fishing zone became 200 nm.<sup>803</sup>

Unfortunately, the contiguous zone type of rights were not separated from the new fishing zone. This resulted in the new 200 nm fishing zone retaining these rights far beyond the maximum distance of 24 nm allowed in LOSC.

Under LOSC islands, in certain circumstances, may generate the same maritime zones as a mainland State.<sup>804</sup> An island must be capable of sustaining human habitation or have an economic life of its own, to generate these zones.<sup>805</sup>

South Africa has claimed an exclusive economic zone and an LOSC continental shelf beyond 200 nm along the mid-oceanic ridge,<sup>806</sup> based on the fact that the Prince Edward Islands Group meet the criteria to generate all zones and that their natural prolongation is along the mid-oceanic ridge. It is

<sup>799</sup> Mainichi Daily News (29 October 1989) p1

<sup>800</sup> Maritime Zones Act n690 Sections 7&8

<sup>801</sup> South African Territorial Waters Act No 87 (1963) p1

<sup>802</sup> *ibid* Section 4

<sup>803</sup> *ibid*

<sup>804</sup> LOSC Article 121(2)

<sup>805</sup> LOSC Article 121(3)

<sup>806</sup> Maritime Zones Act n690 Sections 7 & 8

argued that if an island is able to have a continental shelf, then the foot of the slope should also be at the point of maximum change in gradient of the seabed and the natural prolongation should be the same for an island as for a mainland.

The fact that such a claim would include portions of the deep ocean floor should be seen against a 200 nm continental shelf claim that also includes the deep ocean floor. A similar argument has been advanced by Iceland to extend its continental shelf on the ridge beyond 200 nm which could result in objections being made by other States, particularly those in the region.<sup>807</sup>

### Spratly Islands

These islands are in fact tiny outcrops in the sea and, although they do not appear to justify claims to zones other than territorial seas, their sovereignty is disputed by China, Taiwan, Vietnam, Malaysia, the Philippines and Brunei. The area surrounding the islands is rich in undersea oil and natural gas. In addition, Indonesia, while not claiming sovereignty, is concerned as an adjoining State. It would appear as if the claims of all States lack the required continual and effective administrative control and governance to establish sovereignty. The so-called islands comprise 26 features that are above water at high tide. The largest is less than half a square kilometre and only six others have surface areas greater than 0.1 square kilometre. None has ever sustained a permanent population. It would appear as if the only interest in sovereignty is as a result of the possible zonal claims that such a group could generate.

Until recently none of the States in the region had laid claim to these islands. It would appear also from the evidence made public by the various States that none of them would be able to prove sovereignty over the islands and the only possible peaceful solution would be joint administration and an equitable sharing of the assets.<sup>808</sup>

### HISTORIC ACTIVITIES

Many developing coastal States rely on the resources of their seas, the adjoining seas and the high seas to supply the basic needs of their people.<sup>809</sup> The historic use of the seas and the effect of zonal claims on these traditional uses is a major factor for these States and should be considered when coastal States delimit maritime boundaries. The Treaty between Australia and Papua New Guinea reflects the sensitivity of historic rights and the activities of the nationals of some States.<sup>810</sup>

*Recognising the importance of protecting the traditional way of life and livelihood of Australians who are Torres Strait Islanders and of Papua New Guineans who live in the coastal area of Papua New Guinea in and adjacent to the Torres Strait.*<sup>811</sup>

*Subject to the other provisions of this Treaty each Party shall continue to permit free movement and the performance of lawful traditional activities in and in the vicinity of the Protected Zone by the traditional inhabitants of the other Party.*<sup>812</sup>

### Historic Servitude

It is possible that a State may have granted servitude rights over its sovereign territory to other States.<sup>813</sup> These rights could also have been granted by a predecessor State and that right devolved onto the

<sup>807</sup> Churchill n18 p41 & 310

<sup>808</sup> D J Dzurek "The Spratly Islands Dispute : Who's on First" University of Durham Boundaries Research Unit Maritime Briefings Vol 2 No 1 (1995) p54, B Cloughly "Asean at Arms" International Defence Review 12/1995

<sup>809</sup> Fulton n60 p8 M J Valencia, J M R van Dyke & L Noel "The Solution for the Spratly Islands Ought to Look Like This" Herald tribune (9 October 1995)

<sup>810</sup> Preamble to the Treaty between Australia and the Independent State of Papua New Guinea Sydney (18 December 1978) p1

<sup>811</sup> *ibid*

<sup>812</sup> *ibid* Section 1, LOSC Article 11

<sup>813</sup> Akehurst n10 p156

present State. These servitudes could be for the benefit of more than one State and while most servitudes of this nature are in relation to the passage of vessels in rivers and canals the fact that a State accedes to, or ratifies, LOSC might impact on these historic servitudes.

### **Historic Bays**

LOSC refers to 'historic bays'.<sup>814</sup> There is, however, no definition given in LOSC for this type of bay. The provisions of Article 10 do not apply to bays recognised as 'historic'. As at 1985 there were twenty States that had claimed 'historic bays'. This is a purely legal concept and is not considered further.

### **United States of America's Objections to the Claims of Other States.**<sup>815</sup>

The United States of America has persistently recorded its objections to the zonal and baseline claims of States that they feel are not in accordance with their interpretation of LOSC. The US protested on 30 occasions over the use of baselines which, in their opinion did not comply with LOSC. Eighteen claims were made to either territorial sea or contiguous zone claims that were in excess of the limits allowed in LOSC. The majority of these claims extended to 200 nm from the baselines. On 9 occasions security jurisdiction in the contiguous zone was claimed and a further 5 claims, by far the minority, dealt with claims to either exclusive economic zones or research rights which the US felt did not comply with LOSC. These objections are listed below, as at 11 January 1995. They reflect a conservative approach to LOSC and do not necessarily reflect customary law or the views of other States:

#### **Albania**

Some baselines are also objected to.<sup>816</sup>

#### **Argentina**

- a) Freedom of navigation and overflight guaranteed only seaward of the closing line of Rio de la Plata as an historic bay. This is a joint declaration with Uruguay.<sup>817</sup>
- b) Closing lines of the Gulfs of San Matias and San Jorge.<sup>818</sup>

#### **Benin**

200 nm territorial sea.<sup>819</sup>

#### **Cameroon**

- a) 50 nm territorial sea.<sup>820</sup>
- b) Straight baselines.<sup>821</sup>

#### **Canada**

- a) Straight baselines areas 1,2,3, Labrador and Newfoundland and areas 4,5,6, Nova Scotia and Vancouver and Queen Charlotte and Arctic islands.<sup>822</sup>

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<sup>814</sup> LOSC Article 10(6)

<sup>815</sup> US Department of State National Claims to Maritime Jurisdictions Limits in the Seas No36 (7th Revision) (1995)

<sup>816</sup> *ibid* p 2 Albania: Decree No 5384(1976) - US protested 1989

<sup>817</sup> *ibid* p6 Argentina: Joint Declaration with Uruguay (1961)- US protested 1963

<sup>818</sup> *ibid* p6 Argentina: Law No 17,094 29 December (1966)- US protested 1967

<sup>819</sup> *ibid* p15 Benin: Decree No 76-92 (1976) - US protested 1989

<sup>820</sup> *ibid* p22 Cameroon: Law No 74/16 (1974)- US protested 1968

<sup>821</sup> *ibid* p22 Cameroon: Decree 62-DF-216 (1962)- US protested 1963. Cameroon revises baselines Decree 71/DF/416 (1971)

<sup>822</sup> *ibid* p23 Canada: Territorial Sea and Fishery Zones Act (1964), Orders in Council P.C. (1967)- 2025, (1969) - 1109, (1972) -966, (1985) -2739- US protested 1967, 1969, 1985, and 1986

- b) Fishing jurisdiction proclaimed beyond 200 nm.<sup>823</sup>

## **Cape Verde**

Archipelagic baselines that do not comply with LOSC.<sup>824</sup>

## **Chile**

Control of continental shelf research for Easter and Sala Y Gomez Islands up to 350 nm. This indicates that Chile has claimed a LOSC continental shelf in a geologically active margin. It is highly unlikely that either sediment thickness or 100 nm from the 2500 metre isobath in this margin will justify this claim.<sup>825</sup>

## **Colombia**

Straight baselines.<sup>826</sup>

## **Costa Rica**

Pacific coast straight baselines.<sup>827</sup>

## **Djibouti**

Straight baselines and closing lines of Tadjoura Bay.<sup>828</sup>

## **Ecuador**

- a) Straight baselines for mainland and Galapagos.<sup>829</sup>
- b) Continental shelf claim beyond 200 nm along subsurface Carnegie mountain range.<sup>830</sup>

## **Germany**

The portion of the territorial waters off the previous German Democratic Republic in Helgoland Bucht which reaches 16 nm in width at one place.<sup>831</sup>

## **Grenada**

Certain clauses of exclusive economic zone legislation.<sup>832</sup>

## **Guinea**

Straight baselines.<sup>833</sup>

## **Haiti :**

Straight baselines were published so claims are inferred. The US has objected to both the baselines and the zones calculated from them.<sup>834</sup>

## **Iran**

- a) Straight baselines revised.<sup>835</sup>

<sup>823</sup> ibid p23 Canada: Order in Council (1977), Amendment to Coastal Fisheries Protection Act (1994)- US protested (1994)

<sup>824</sup> ibid p25 Cape Verde: Decree Law No 126/77 (1977)- US protested 1980

<sup>825</sup> ibid p26 Chile : Foreign Ministry Statement (1985)- US protested 1986

<sup>826</sup> ibid p28 Colombia: Decree No 1436 (1984)- US protested 1988

<sup>827</sup> ibid p32 Costa Rica: Law No 18581-RE (1988)- US protested 1989

<sup>828</sup> ibid p40 Djibouti: Decree No 85-048 (1985)- US protested 1989

<sup>829</sup> ibid p43 Ecuador: Decree No 959-A (1971)- US protested 1986

<sup>830</sup> ibid p43 Ecuador: Presidential Proclamation (1985)- US protested 1986

<sup>831</sup> ibid p58 German Democratic Republic Ordinance- Federal Legal Gazette Part I (1985) - US protested 1982

<sup>832</sup> ibid p62 Grenada: Marine Boundaries Act No 20 (1978)- US protested 1982

<sup>833</sup> ibid p64 Guinea: Decree No 224/PRG/64 (1964)- US protested 1964

<sup>834</sup> ibid p67 Haiti: Decree (1972)- US protested 1989

b) Exclusive economic zone claim.<sup>836</sup>

## Italy

Straight baselines.<sup>837</sup>

## Democratic Peoples Republic of Korea (North)

Limits of military security zone published infer straight baselines in Sea of Japan.<sup>838</sup>

## Libya

Gulf of Sidra closed as internal waters with a straight line approximately 300 nm long.<sup>839</sup>

## Mauritania

Straight baseline drawn from Cap Blanc to Cap Timiris.<sup>840</sup>

## Mexico

Straight baselines established in the Gulf of California.<sup>841</sup>

## Oman

Straight baselines.<sup>842</sup>

## Portugal

Straight baselines drawn on mainland and around Madeira and the Azores.<sup>843</sup>

## Russia

Straight baselines established for coasts in the Baltic, Black Sea and Arctic Ocean.<sup>844</sup>

## Senegal

Straight baselines.<sup>845</sup>

## Sri Lanka

Claims to security jurisdiction over contiguous zone 1977.<sup>846</sup>

## Uruguay

Freedom of navigation guaranteed only seaward of the closing line.<sup>847</sup>

## Venezuela

a) Straight baselines.<sup>848</sup>

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<sup>835</sup> ibid p73 Iran: Marine Areas Act (1993)-US protested 1994

<sup>836</sup> ibid p73 Iran: Marine Areas Act (1993)- US protested 1994

<sup>837</sup> ibid p77 Italy: Presidential Decree No 816 (1978)- US protested 1984, 1986, and 1987

<sup>838</sup> ibid p83 Democratic Peoples Republic of Korea (North): Announcement (1977)- US protested 1990

<sup>839</sup> ibid p89 Libya: Foreign Ministry Note Verbale MQ/40/5/1/3345 (1973)- US protested (1974,1979 and1985

<sup>840</sup> ibid p96 Mauritania: Law 67-023 1967, Ordinance 88-120 (1988)- US protested 1990

<sup>841</sup> ibid p98 Mexico: Decree (1968)- US protested 1969

<sup>842</sup> ibid p111 Oman: Decree No 38/82 (1982)- US protested 1991

<sup>843</sup> ibid p119 Portugal: Decree Law No 495/85 (1985)- US protested that archipelagic baselines may not be drawn around islands of a continental State and they also protested to some of the straight baselines on the mainland 1986

<sup>844</sup> ibid p123 Russia: Council of Ministers Decree (1985)- US protested 1984, 1985, 1986 and 1988

<sup>845</sup> ibid p129 Senegal: Decree 72-765 (1972)- US protested 1989

<sup>846</sup> ibid p138 Sri Lanka: Proclamation (1977)- US protested (1986)

<sup>847</sup> ibid p159 Uruguay: Joint Declaration with Argentina.(1961)- US protested 1963

- b) Contiguous zone claims for control for national interests.<sup>849</sup>

#### **Vietnam**

- a) Portions of the Gulf of Tonkin and the Gulf of Thailand closed with straight baselines and claimed as historic waters.<sup>850</sup>
- b) Security jurisdiction claimed in the contiguous zone.<sup>851</sup>

#### **Yemen**

- Security jurisdiction claimed in the contiguous zone.<sup>852</sup>

### **Delimitation of Concessions Given in the Zones of a Coastal State**

Generally, undersea mining is undertaken in demarcated concession areas on the geological continental shelf. In the case of diamond mining off the coast of the northern Cape in South Africa and off Namibia, these operations are an extension of the mining that is undertaken on the land and on the beach. The richness of these deposits is such that relatively narrow submarine concession areas are awarded. As technology improves, and as it becomes possible for these operations to extend further and further seawards the positioning of the limits of these concessions becomes more difficult.<sup>853</sup>

Special charts are being prepared on which the geodetically computed limits are plotted.<sup>854</sup> A major problem will still exist where the positioning is beyond the range of a terrestrial navigation system or where this system is unable to provide the required accuracy. Concessions and diving operations are expected to extend to beyond the 1500 metres isobath which occurs up to approximately 150 nm from the coast.<sup>855</sup>

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<sup>848</sup> ibid p161 Venezuela: Presidential Decree (1956)

<sup>849</sup> ibid p161 Venezuela: Presidential Decree (1968), Territorial Sea Law (1956)- US protested (1989)

<sup>850</sup> ibid p162 Vietnam: Statement (1982)- US protested 1982

<sup>851</sup> ibid p162 Vietnam: Statement (1977)- US protested (1982)

<sup>852</sup> ibid p164 Yemen: Resolution No 17(Sanaa) Act No 45, Aden (1967, and 1978)- US protested (1986)

<sup>853</sup> C Rommelaere "Demarcation of Coastal Mining Boundaries" SASJ (September 1982) p12

<sup>854</sup> SAN Chart MZ1

<sup>855</sup> SANHO Records (dated 13 July 1993), SAN Chart No's 53/54



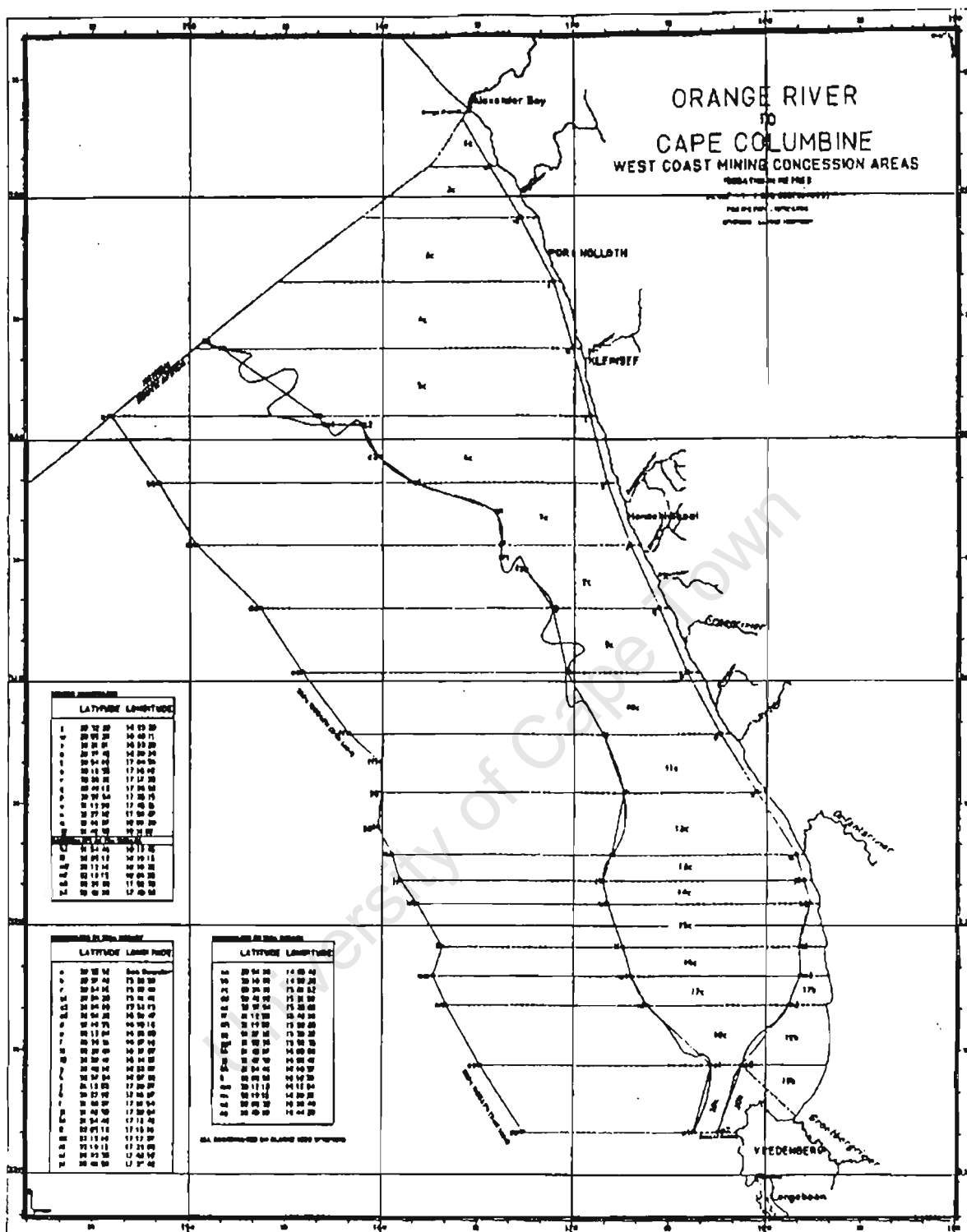


Figure 62 DIAMOND CONCESSION AREAS OFF THE COAST OF SOUTH AFRICA

## COMMENTED GLOSSARY OF TERMS RELEVANT TO DELIMITATION IN LOSC

(Unless otherwise stated all definitions are taken from AJ Kerr, NR Guy et al IHO Manual on Technical Aspects of United Nations Convention on Law of the Sea 1982 3rd Ed 1993.)

### ADJACENT COASTS<sup>856</sup>

*The coasts either side of the land boundary between two adjoining States* *Comment* *The position of a coast is given by the normal baselines (low-water line) adopted by the coastal State,*<sup>857</sup>

### ARCHIPELAGIC STRAIGHT BASELINES<sup>858</sup>

*These baselines may be drawn in accordance with Article 47 LOSC.*

#### Comment

Archipelagic baselines have different criteria to those of normal and straight baselines. The waters contained within these baselines are subject to different regimes to the internal waters normally enclosed by baselines.<sup>859</sup> The major differences between these baselines and other straight baselines is that the archipelagic State may enclose large areas of water as archipelagic waters but may not exert as much control in these waters as a coastal State would in its internal waters.

### ARCHIPELAGIC STATE<sup>860</sup>

For the purpose of LOSC both an archipelago and the archipelagic State are defined as follows;

*a) archipelago means a group of islands, including parts of islands, interconnecting waters and other natural features which are so closely inter-related that such islands, waters and other natural features form an intrinsic geographical, economic and political entity, or which historically have been regarded as such.*

*b) archipelagic State means a State constituted wholly by one or more archipelagos and may include other islands.*<sup>861</sup>

#### Comment

The above definitions are specific and exclude States that are partially situated on a continent, such as Denmark with the Faroe Islands, Ecuador with the Galapagos Islands, Norway with Spitsbergen and Portugal with the Azores. The UK with the Falklands, St Helena and other islands would not qualify, because they do not form an intrinsic geographical entity. Japan and New Zealand do not claim archipelagic status.<sup>862</sup>

Portugal has drawn archipelagic baselines around the Azores islands in spite of being a continental State. India regards the definition as discriminatory. It wishes to draw baselines around the Laccadive archipelago, as this would simplify its zones.<sup>863</sup> As India is a mainland State archipelagic baselines may not be drawn around the islands, even if they are treated as being a separate entity from mainland India.

<sup>856</sup> LOSC Articles. 15, 74(1), 76(10), 83(1), 134(4), A2/9

<sup>857</sup> LOSC Article 5

<sup>858</sup> LOSC Articles 47, 48, 49(1)

<sup>859</sup> LOSC Articles 49

<sup>860</sup> LOSC Articles 2, 26-54

<sup>861</sup> LOSC Article 46

<sup>862</sup> Churchill n18 p100

<sup>863</sup> International Association of Geodesists Proceedings GALOS Conference Bali (1996)

## AREA <sup>864</sup>

*'Area' means the seabed and ocean floor and subsoil thereof, beyond the limits of national jurisdiction.*

### Comment

The seabed under the high seas constitutes the 'Area', when not a part of the continental shelf claim of a coastal State. It is the subject of many Articles that require the States Party to preserve and protect it. The Authority is the body created by LOSC to undertake this responsibility on behalf of the States Party, it has no jurisdiction in the waters and the airspace above the Area.

## ARTIFICIAL ISLAND (Offshore Installation) <sup>865</sup>

*Manmade structures in the territorial sea, exclusive economic zone or on the continental shelf are usually erected for the exploration or exploitation of marine resources. They could also be built for marine scientific research, tide observations, and oceanographic observations.*

### Comment

As in the case of a lighthouse erected on a low-tide elevation, if an installation has been erected on a low-tide elevation, and is permanently above sea level, straight or archipelagic baselines may be drawn to and from it. Where they are erected on the seabed, they are not considered as permanent harbour works and may not be used to generate baselines.

## BASELINE

*The line from which the outer limits of a State's territorial sea and certain other outer limits of coastal State jurisdiction are measured.*

### Comment

The term refers to the baseline from which the breadth of the territorial sea, the outer limits of the contiguous zone, the exclusive economic zone and, in some cases, the LOSC continental shelf are measured. It is also the dividing line between internal waters and territorial seas. The 'normal baseline' is the low-water line along the coast (including the coasts of islands) as marked on large-scale charts officially recognised by the coastal State. <sup>866</sup>

In the case of islands situated on atolls or of islands having fringing reefs, the baseline is the seaward low-water line of the reef, as shown by the appropriate symbol on charts officially recognised by the coastal State. <sup>867</sup>

Where a low-tide elevation is situated wholly or partly at a distance not exceeding the breadth of the territorial sea from the mainland or an island, the low-water line on that elevation may be used as part of the baseline. <sup>868</sup>

Many States have drawn closing lines of bays that do not comply with the Articles of LOSC. <sup>869</sup> Some of these lines could be regarded as straight baselines as the bay that they are closing is so shallow. They could not be regarded as complying with Article 10 LOSC. Co-ordinates of straight baselines and the closing lines of bays do not have to be submitted to the UN.

<sup>864</sup> LOSC Articles. 1(1)(1), 137, 211(6)

<sup>865</sup> LOSC Articles. 7(4), 11, 21(1)(b), 47(4), 59(1)(b)(i), 60, 79(4), 80, 87(1)(d), 145(a), 147(2)(a)(c)(e), 246(5)(c), 249(1), 258-262

<sup>866</sup> LOSC Article 5

<sup>867</sup> LOSC Article 6

<sup>868</sup> LOSC Article 13

<sup>869</sup> UN DOALOS Publication n327

The type of the territorial sea baseline may vary depending on the geographical configuration of the locality.<sup>870</sup>

The normal baseline (low-water line) is the natural baseline. It is the interests of the coastal State to determine the lowest low-water line to maximise its claims. As has been shown it is not a practical datum that is easily surveyed and positioned.<sup>871</sup>

Straight baselines simplify delimitation but they also commence and end on the low water line. Certain aspects of straight baselines, such as maximum length, are not contained in LOSC. Many States have adopted baselines to simplify the outer limits of their maritime zones that comply with the criteria in LOSC. Straight baselines are systems of straight lines joining specified or discrete points on the low-water line, usually known as straight baseline turning points, which may be used only in localities where the coastline is deeply indented and cut into, or if there is a fringe of islands along the coast in the immediate vicinity.<sup>872</sup>

Archipelagic baselines have been used extensively by some States. As shown in this Chapter some are not in accordance with LOSC. Archipelagic baselines are straight lines joining the outermost points of the outermost islands and drying reefs. They may be used to enclose all or part of an archipelago which forms all or part of an archipelagic State.<sup>873</sup>

Closing lines of bays are not classified as straight baselines. To close a bay, the bay and the closing line must comply with criteria contained in LOSC. These criteria are different from those contained in LOSC for straight baselines but the closing lines have the same effect as straight baselines when the outer limits of maritime zones are calculated.<sup>874</sup>

#### **BASEPOINT (Referred to as 'point' in LOSC)<sup>875</sup>**

*A basepoint is any point on a baseline.*

#### **Comment**

Any point on a normal baseline may be used to generate the outer limits of a zone. These points are referred to as 'basepoints'. One of the major problems in implementing LOSC is the use of basepoints as the low-waterline is a nebulous boundary to determine. Basepoints on the normal baseline and the outer limits of zones determined by distances from these basepoints could be inaccurate unless great care is taken during the survey of the low-water line.<sup>876</sup>

In a system of straight baselines, where one straight baseline meets another at a common point, the line maybe said to 'turn' at that point. Such a point may be termed a 'baseline turning point' or, also simply a 'basepoint'.

#### **BAY**

*For the purposes of this Convention, a bay is a well-marked indentation whose penetration is in such proportion to the width of its mouth as to contain land-locked waters and constitute more than a mere curvature of the coast. An indentation shall not, however, be regarded as a bay unless its area is as large as, or larger than, that of the semi-circle whose diameter is a line drawn across the mouth of that indentation.<sup>877</sup>*

<sup>870</sup> LOSC Articles. 47, 48, 49(1)

<sup>871</sup> LOSC Article 5

<sup>872</sup> LOSC Articles. 3, 4, 7, 8, 9, 11, 14, 15, 16, 35(a), 57, 76

<sup>873</sup> LOSC Articles. 3, 4, 15, 16, 47, 48, 49(1), 57, 76

<sup>874</sup> LOSC Articles. 10, 16, 57, 76

<sup>875</sup> LOSC Article 16(1)

<sup>876</sup> O'Connell n47 p172-184, Churchill n18 p27

<sup>877</sup> LOSC Article 10 (2)

### Comment

The practice of States in closing bays, as indicated in this Chapter, does not, on many occasions, comply with the requirements of LOSC. Many of the bays shown in Scovazzi's Atlas appear to be beyond the limits allowed by LOSC.<sup>878</sup> With the exception of the United States, few countries have protested these practices. It would appear that the practice is becoming sufficiently common among States to be considered customary law, superseding LOSC.

### Historic Bays<sup>879</sup>

This type of bay is not defined either in LOSC or the TALOS Manual and is considered to be governed by international customary law.<sup>880</sup> There are no non-legal aspects that need be considered.

### CHART<sup>881</sup>

*A nautical chart specifically designed to meet the needs of marine navigation. It depicts such information as depths of water, nature of the seabed, configuration and nature of the coast, dangers and aids to navigation, in a standardised format, also called simply, Chart.*

### Comment

As discussed in Chapters IV, V, VI, and VII the nautical chart is not ideal for delimitation purposes. In some instances it is the only data available but if circumstances allow, comprehensive bathymetric and seismic data, geodetically controlled, are necessary to achieve the best technical solution. Charts are necessary for everyday use by mariners and coastal authorities where enforcement in maritime zones is required.

### CLOSING LINE<sup>882</sup>

*A dividing line between the internal waters and the territorial seas of a coastal State enclosing a river mouth, a bay or a harbour, or the archipelagic waters of an archipelagic State.*  
*Comment The bay closing line has been discussed under Baselines above.*

### COAST<sup>883</sup>

*The edge or margin of the land next to the sea.*

### Comment

The baselines of a coastal State are at the most seaward points of the coast. For delimitation purposes the 'coast' of a coastal State is coincidental with the 'normal' baseline.

### CONTINENTAL MARGIN (See also Chapter VI)<sup>884</sup>

*The continental margin comprises the submerged prolongation of the landmass of the coastal State, and consists of the seabed and subsoil of the shelf, the slope and the rise. It does not include the deep ocean floor with its oceanic ridges or the subsoil thereof.*

### Comment

This is a marine-geological definition, which unfortunately clashes with the LOSC definition of the continental shelf. The shelf referred to in the above definition is a marine-geological shelf.

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<sup>878</sup> Scovazzi n46

<sup>879</sup> LOSC Article 10 (6) & 298 (1)(a)(i)

<sup>880</sup> Churchill n18 p36

<sup>881</sup> LOSC Articles. 5, 6, 16, 22(4), 41(6), 47(8)&(9), 453(10), 75, 76(9), 84, 134(3)

<sup>882</sup> LOSC Article 50

<sup>883</sup> LOSC Article 15, 74(1), 76(1), 83(1), 134(4), A2/9

<sup>884</sup> LOSC Articles 76(1)(3)(4)(a) & (6)

LOSCH contains provisions for a minimum continental shelf claim of 200 nm for any coastal State which could include portions of the deep ocean floor and its oceanic ridges.

#### **CONTINENTAL RISE (See also Chapter VI) <sup>885</sup>**

*A submarine feature which is part of the continental margin lying between the continental slope and the deep ocean floor, simply called the 'rise' in the Convention.*

#### **Comment**

Although the term appears only once in Article 76(3) LOSC the continental rise is an important submarine feature. It consists of debris that has been deposited at the foot of the continental slope from the continental shelf. It forms an important boundary within the continental slope. The boundary is the 'foot of the slope' which is defined as the point of maximum change of slope between the continental slope and the continental rise. <sup>886</sup> (See also the definition of 'foot of the slope') <sup>887</sup>

The thickness of the sediment in the continental rise is a factor that can be used for the determination of the outer limits of the LOSC continental shelf. <sup>887</sup>

#### **CONTINENTAL SLOPE (LOSCH) (See also Chapter VI) <sup>888</sup>**

*That part of the continental margin that lies between the marine-geological continental shelf and the rise. Simply called the slope in LOSCH.*

#### **Comment**

The extent and configuration of continental slopes vary considerably. As the foot of the slope is a major feature for a LOSC continental shelf claim, surveys in the region of the slope and its foot are essential if the maximum extent of a claim is to be realised.

#### **Foot of the Continental Slope <sup>889</sup>**

*In the absence of evidence to the contrary, the foot of the continental slope shall be determined as the point of maximum change of gradient at its base.*

#### **Comment**

While it is possible that a simple configuration of the seabed will facilitate the identification of the 'foot of the slope' it is more likely that the point of maximum change of slope will not be evident. In addition, it is possible that there will be more than one slope and an accurate profile will be necessary to identify the 'foot of the slope' that is to the benefit of the coastal State, while being justifiable.

#### **DELTA <sup>890</sup>**

*A tract of alluvial land enclosed and traversed by the diverging mouths of a river.*

#### **Comment**

The inclusion of this feature in LOSC is related to the use of straight baselines. There is the possibility that a delta will be unstable, with the exposed area changing constantly with deposition of sediment and erosion by wave-action.

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<sup>885</sup> LOSC Article. 76(3)

<sup>886</sup> LOSC Article 76(4)(b)

<sup>887</sup> LOSC Article 76(4)(a)(i)

<sup>888</sup> LOSC Article 76

<sup>889</sup> *ibid*

<sup>890</sup> LOSC Article. 7(2)

..., the straight baselines shall remain effective until changed by the coastal State in accordance with this Convention.<sup>891</sup>

The construction of the Aswan Dams on the Nile River has resulted in sediment being trapped in the dams and not deposited in the Nile Delta.

*it should be recognised that these dams also retain silt. Where the inflowing river is a major source of sediment the balance between deposition and erosion is disturbed so that the shoreline around the mouth of the river may recede. This has already happened in the Nile Delta since the construction of the high Aswan Dam with consequent adverse effects on some biota.*<sup>892</sup>

The Mississippi Delta has prograded with seven lobes since the sea-level stabilised about 6000 years ago. An eighth lobe has commenced.<sup>893</sup>

## DUE PUBLICITY<sup>894</sup>

*Notification of a given action for general information through appropriate authorities within a reasonable amount of time in a suitable manner.*

### Comment

When a coastal State makes claim to baselines, maritime zones, or engages in any of the activities in these zones for which provision is made in LOSC, then it is in the interest of all States that they be advised by the quickest method. This could be, initially, by means of Notices to Mariners issued by the Hydrographic Offices of most coastal States. Subsequently official notice may be given through diplomatic channels and the Secretary General of the United Nations advised. There is also a requirement that the Secretary General of the UN give due publicity to some of the data submitted to him.

## EQUIDISTANT LINE (Median Line)<sup>895</sup>

*A line, every point of which is equidistant from the nearest points on the baselines of two States.*

### Comment

This method of delimitation is described, but not named, in LOSC. If States fail to agree on either a lateral boundary or a median line, neither State may claim beyond a line which is effectively an equidistance line.

## GEOGRAPHICAL CO-ORDINATES<sup>896</sup>

Geographical co-ordinates are defined in Chapter IV.

### Comment

LOSC requires that geographical co-ordinates are calculated at the terminals of straight and archipelagic baselines, bay closing-lines,<sup>897</sup> traffic-separation schemes and sea-lanes,<sup>898</sup> roadsteads,<sup>899</sup>

<sup>891</sup> *ibid*

<sup>892</sup> G Randozza et al Human-Induced Sedimentological Changes in Manzala Lagoon, Nile Delta, Egypt, *Environmental Geology* 36 (3-4) (December 1998) S B Saila "Fishery Resources and Estuarine Modifications" P Hamilton & K B Macdonald (eds) *Estuarine and Wetland Processes with Emphasis on Modelling* (1980) p607

<sup>893</sup> Shepard n462 p217-218 K R Dyer (ed) "Estuarine hydrography and sedimentation" *Estuarine and brackish-water sciences association handbook* (1979) p2

<sup>894</sup> LOSC Articles. 16(2), 21(3)&(4), 41(2)&(6), 42(3), 47(9), 53(7)&(10), 75(2), 76(9), 84(2)

<sup>895</sup> LOSC Article. 15

<sup>896</sup> LOSC Articles. 16(2), 47(8)&(9), 75,

<sup>897</sup> LOSC Article 16

outer limits of exclusive economic zones<sup>900</sup> and the continental shelf.<sup>901</sup> These co-ordinates are required to be forwarded to the Secretary General of the UN and due publicity given to them.

## **ISLANDS**<sup>902</sup>

Islands are defined in Chapter V.

### **Comment**

The types of islands and the effect that they can have on delimitation has been commented on in this Chapter and in Chapter V

## **ISOBATH**<sup>903</sup>

*A line representing the horizontal contour of the seabed at a given depth.*

### **Comment**

This term appears only once in LOSC as the basis for a limiting criterion for an LOSC continental shelf determination. 100 nm from the 2500 metre isobath is one of the two criteria for a claim.

## **LAND/WATER RATIO**<sup>904</sup>

*An archipelagic State may draw straight baselines joining the outermost points of the outermost islands and drying reefs of the archipelago provided that within such baselines are included the main islands and an area in which the ratio of the area to the area of land, including atolls is between 1 to 1 and 9 to 1.*

### **Comment**

Archipelagic baselines are governed by different criteria to those of straight baselines. Although no limit has been placed in the LOSC Articles on the length of straight baselines, it is considered that the provision for archipelagic baselines to approximate 100 nm and for 3% of them to approximate 125 nm would be excessive if they were applied to straight baselines.<sup>905</sup> The ratio of water to land, enclosed within proposed archipelagic baselines, is important therefore in establishing whether the islands may be regarded as an archipelago.

If the land area enclosed by the baselines is greater than the water area then archipelagic baselines. Similarly if the islands are so widely dispersed as to enclose water areas greater than the land areas by the ratio of 9 to 1 then LOSC prevents archipelagic baselines being drawn and enclosing an unrealistic amount of water.

## **LOW-TIDE ELEVATION**<sup>906</sup>

*A low-tide elevation is a naturally formed area of land, which is surrounded by and above water at low tide, but is submerged at high tide.*

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<sup>900</sup> LOSC Article 22(4)

<sup>909</sup> LOSC Article 16

<sup>900</sup> LOSC Article 75

<sup>901</sup> LOSC Article 76(9)

<sup>902</sup> LOSC Articles. 6, 7(1), 10, 13, 38(1), 46, 47(1), (4) & (7), 53(5), 60(8), 121, 147(2)(e), 246(5)(c), 259 887

<sup>903</sup> LOSC Article 76(5)

<sup>904</sup> LOSC Article 47(1)

<sup>905</sup> LOSC Article 47(2)

<sup>906</sup> LOSC Articles 7(4), 13, 47(4)



## Comment

Low tide elevation is a legal term for drying banks or rocks. They are important in delimitation as they may extend the outer limit from their low-water line, provided that they are wholly or partly within twelve mile from the baselines from which the territorial sea is measured. Straight baselines may only be drawn to low-tide elevations if lighthouses or similar installations have been erected on them.

## MEDIAN LINE<sup>907</sup>

*A line, every point of which is equidistant from the nearest points on the baselines of two or more States*

## Comment

'Median Line' is the term used to describe the equidistant line, calculated between the baselines of two or more opposite States. For accurate results, geodetic methods should be employed in the computations.

## MARITIME ZONES

### Contiguous Zone<sup>908</sup>

*1. In a zone contiguous to its territorial sea, described as the contiguous zone, the coastal State may exercise the control necessary to:*

*(a) prevent infringements of its customs, fiscal, immigration or sanitary laws and regulations within its territory or territorial sea;*

*(b) punish infringement of the laws and regulations committed within its territorial sea.*

*2. The contiguous zone may not extend beyond 24 nautical miles from the baselines from which the breadth of the territorial sea is measured.*

## Comment

The delimitation of the outer limits of this zone are similar to those of the territorial sea. In view of the possibility of a coastal State enforcing certain of its national laws in this zone it would be advisable for the coastal State to give due notice of the co-ordinates of the outer limits of this zone.

### Continental Shelf (LOSC) (See also Chapter VI)<sup>909</sup>

*The LOSC continental shelf of a coastal State comprises the seabed and subsoil of the submarine areas that extend beyond its territorial sea throughout the natural prolongation of its land territory to the outer edge of the continental margin, or to a distance of 200 nautical miles from the baselines from which the breadth of the territorial sea is measured where the outer edge of the continental margin does not extend up to that distance.*

## Comment

The LOSC continental shelf, as defined above, may be extended using the criteria contained in Article 76 LOSC. The claim may however not extend beyond either 350 nm from the baselines or 100 nm from the 2500 metre isobath, whichever is the greater. The outer limit may not be more than 60 nm from the 'foot of the slope' or more than 100 times the sediment thickness at the outer limit, whichever is the greater.

<sup>907</sup> LOSC Article 15

<sup>908</sup> LOSC Articles 33(1)& (2), 48, 111(1), 111(4), 121(2), 303(2)

<sup>909</sup> LOSC Articles 48, 76, 77(3), 78, 79, 80, 83, 84, 134(4), 147(2), 259, A2/3(1)(a), A2/4, A2/9

### **Exclusive Economic Zone (EEZ) <sup>910</sup>**

*The exclusive economic zone is an area beyond and adjacent to the territorial sea, subject to the specific legal regime established in this Part, under which the rights and jurisdiction of the coastal State and the rights and freedoms of other States are governed by the relevant provisions of this Convention.* <sup>911</sup>

*The exclusive economic zone shall not extend beyond 200 nautical miles from the baselines from which the breadth of the territorial sea is measured.* <sup>912</sup>

#### **Comment**

The computation of the outer limits of the exclusive economic zone, like the contiguous zone, is relatively simple, as it is based on the baselines for the territorial sea. Where there are overlapping claims a delimitation is necessary. Other rights accorded the coastal State, by LOSC in an exclusive economic zone, apply to exploration, exploitation and protection of both the mobile and sedentary resources in the zone. <sup>913</sup> In the enforcement of its rights, the coastal State must take due regard of rights and obligations of other States. <sup>914</sup>

### **Internal Waters <sup>915</sup>**

*Except as provided in Part IV, waters on the landward side of the baseline of the territorial sea form part of the internal waters of the State.* <sup>916</sup>

*Within its archipelagic waters, the archipelagic State may draw closing lines for the delimitation of internal waters, in accordance with Articles 9, 10, and 11.* <sup>917</sup>

#### **Comment**

Internal waters are an extension of the sovereignty of the coastal State with the exception that innocent passage may prevail in certain areas. A coastal State may regard internal waters as sovereign territory and may enforce all national law in the area. The only exception occurs where waters were previously accepted as being territorial waters and have now been enclosed as internal waters. The right of innocent passage must be allowed in these internal waters. A State exercises complete sovereignty over its internal waters with the exception that a right of innocent passage exists for foreign vessels in areas that had not been considered as internal waters prior to the establishment of a system of straight baselines. <sup>918</sup>

### **Territorial Sea <sup>919</sup>**

*A belt of water of defined breadth, but not exceeding 12 nautical miles, measured seaward from the territorial sea baselines.*

#### **Comment**

This is probably the most important zone that can be claimed by a coastal State as it extends the State's sovereignty over the sea, its seabed and subsoil and the air space above it. The sovereignty is

<sup>910</sup> LOSC Articles 55-75, 121(2) & (3), 122, 297(3)(a) & (b)(i)

<sup>911</sup> LOSC Article 55

<sup>912</sup> LOSC Article 57

<sup>913</sup> LOSC Article 61

<sup>914</sup> LOSC Article 58

<sup>915</sup> LOSC Articles 2(1), 7(3), 8, 10(4), 35(a), 50

<sup>916</sup> LOSC Article 8(1)

<sup>917</sup> LOSC Article 50

<sup>918</sup> LOSC Article 8(2)

<sup>919</sup> LOSC Articles. 2-7, 10-32, 48, 52, 121(2), 125, 211(4), 245, 259

exercised subject to the provisions of LOSC and international conventions. Arising from these provisions, the right of innocent passage is a major obligation on the coastal State.

*The coastal State's sovereignty extends to the territorial sea, its seabed and subsoil, and to the air space above it. This sovereignty is exercised subject to the Convention and to other rules of international law.*

*The major limitations on the coastal State's sovereignty in the territorial sea are provided by the rights of innocent passage for foreign ships and transit passage and archipelagic sea-lanes passage for foreign ships and aircraft.*<sup>920</sup>

## **MEDIAN LINE**

*A line every point of which is equidistant from the nearest points on the baselines of two States.*

### **Comment**

It is usual to refer to 'median line' in the case where there is a boundary delimitation between opposite States and an 'equidistant line' where the delimitation is between adjacent States. This distinction is not contained in LOSC but it has become commonly used.

## **REEF**

*A mass of rock or coral which either reaches close to the sea surface or is exposed at low tide.*

*DRYING REEF. That part of a reef which is above water at low tide but submerged at high tide.*

*FRINGING REEF. A reef attached directly to the shore or continental landmass, or located in their immediate vicinity. In the case of islands situated on atolls or of islands having fringing reefs, the baseline is the seaward low-water line of the reef, as shown by the appropriate symbol on charts officially recognised by the coastal State.*

### **Comment**

Both the horizontal position and the depth of a reef are important in the consideration of normal baselines and the drawing of straight and archipelagic baselines. It may be possible to extend the outer limits of a coastal State's maritime zones considerably by the determination of the low-water line of a reef.

## **OUTER LIMIT**<sup>921</sup>

*The extent to which a coastal State claims or may claim a specific jurisdiction in accordance with the provisions of the Convention.*

### **Comment**

The outer limits of all zones with the exception of an LOSC continental shelf, are computed by using specified distances from the baselines. If the criteria allow it, the outer limit of the LOSC continental shelf could bear a maximum criteria of 350 nm from the baselines. These outer limits should be geodetically computed, co-ordinates should be given due publicity and submitted to the Secretary General of the United Nations.

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<sup>920</sup> IHO n192 p27

<sup>921</sup> LOSC Articles. 4, 75(1), 76, 84(4), 134(4), A2/3(1)(a), A2/4, A2/7

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## CHAPTER IX

## NAVIGATION AND COMMUNICATIONS

## INTRODUCTION

Navigation, whether on land, sea or in the air is only a method of ensuring safe travel. It has always been the essential element in transportation. Within this general definition the consequences of the various rights, privileges and obligations of the coastal, foreign or Flag States are relevant.

It is considered that marine navigation has existed in one form or another, for more than 6000, possibly 8000, years. During this lengthy period it has been transformed from an art into a science.<sup>922</sup>

In Chapter VI the various types of positioning systems and survey methods were considered. Navigation depends on the same, or similar, systems. The requirement for a coastal State to survey its marine areas is relatively small, but the mariner is constantly dependent on accurate navigational information for the safety of his vessel.

Surveyors are expected to provide accurate information surveyed to acceptable standards to enable navigators to position their vessels accurately. This information should be easily understandable, accurate, and clearly displayed. As it is usually impossible to mark the limits of the various maritime zones at sea, co-ordinate values of these positions are made available and depicted on the charts of the coastal State. The navigator, therefore, has only this information to ensure that he does not transgress any restricted areas or related laws of the coastal State.

Accuracy of navigation of both foreign vessels and those of the coastal State, some of which may be involved in enforcement in these zones, must be comparable. The navigational provisions contained in LOSC affect the coastal State and the vessels of foreign States in passage, or engaged in any other activities, in the zones of the coastal State. All States are affected by the Articles dealing with activities on the high seas. The historical development of these rights, up to the coming into force of LOSC has been dealt with in Chapters I-III. This Chapter will consider therefore the impact of the relevant Articles of LOSC on air and sea navigation over or in the areas described in LOSC against the background of the phenomenal technical developments in navigation and navigation systems.

The various zones that should be considered are, internal waters, territorial waters, the exclusive economic zone, or an exclusive fishing zone and the high seas. International waterways and straits, while not occurring in southern Africa, will however also be considered.

Aspects of LOSC that could be regarded as communications will also be considered in this Chapter.

Communication means;

*imparting or exchange of information, social dealings or connection or means of access between places or things*<sup>923</sup>

<sup>922</sup> Bowditch n572 p15

<sup>923</sup> Concise Oxford Dictionary 8th Ed (1990)

## INTERNAL WATERS

### Rights, Privileges and Obligations of the coastal State

The rights and privileges of a coastal State in its maritime zones could constitute restrictions for navigation by other States. The coastal State may enforce all national legislation, except aboard public (state owned) vessels or warships. Most coastal States leave matters relating to the purely internal economy nature of the vessel to the legislation of the Flag State. This is providing that its own interests and those of its nationals are not threatened or compromised.<sup>924</sup> The application of, and the extent to which local law is applied, varies from State to State.

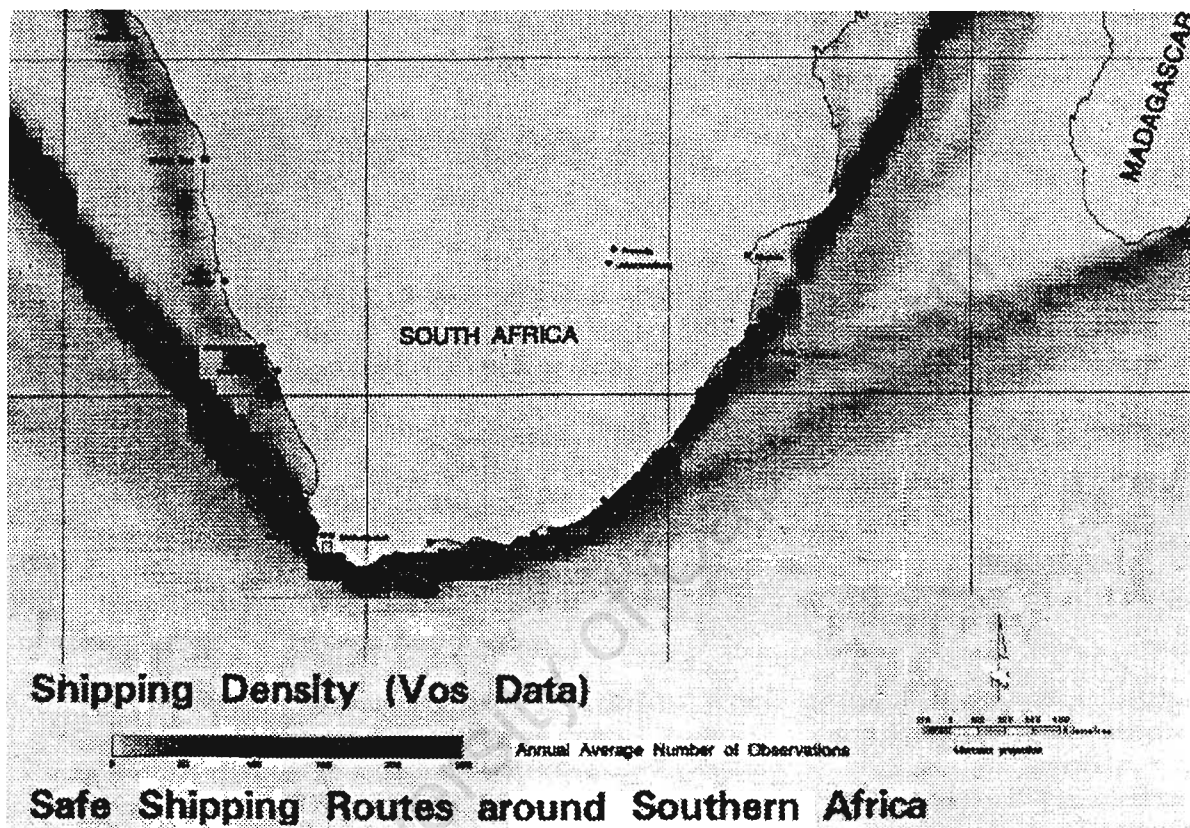


Figure 63 SHIPPING DENSITY DIAGRAM AROUND THE SOUTH COAST OF SOUTH AFRICA

The attitude of the United States is reflected in *Cunard v Mellon*.<sup>925</sup> The US regards its right to enforce its law in internal waters as absolute whereas the French do not enforce national law aboard a foreign vessel in purely internal matters.<sup>926</sup>

The US requires that ships indicate other States with which they are trading or it may try to impose local labour laws on foreign visiting ships.<sup>927</sup> This is generally regarded by other States as excessive and unacceptable.<sup>928</sup>

Although there are no non-legal aspects related to the recognition accorded a State's legislation by another State it is noted that such recognition falls into two categories. The first theory is dualistic.

<sup>924</sup> Churchill n18 p49

<sup>925</sup> Cunard SS n113

<sup>926</sup> Churchill n18 p55

<sup>927</sup> *ibid*

<sup>928</sup> *ibid*

The basic tenet is that if a transgression occurs in the territorial jurisdiction of a foreign State a State may choose to recognise the jurisdiction of the foreign State, subject to certain municipal law exceptions concerning the public policy of the forum.

The second theory is essentially monist and the basic rule for the recognition of the foreign jurisdiction must include the following;

- a) the act must occur within the territorial jurisdiction of the State taking action and*
- b) it must be the sort of act that international law permits territorial action to be taken.*<sup>929</sup>

A number of principles are relevant in considering coastal State enforcement rights such as the Active Personality Principle, the Passive Personality Principle, and the Objective Territorial Principle. The latter featured significantly in the Lotus Case.<sup>930</sup>

## ACCESS RIGHTS

### Access

The right of access has normally purely legal implications but the control of any access and the determination as to whether such access is warranted has technical aspects that should be considered. LOSC provides for the rights of coastal States in its maritime zones but these rights do not affect the legal status of the superjacent waters and the airspace above these waters. A coastal State may not infringe, in any way, on the navigational and other rights and freedoms of other States provided for in LOSC. The coastal State is encouraged to adopt rules and regulations that give access, to foreign research vessels engage in programmes that comply with Part XIII LOSC, to their harbours.<sup>931</sup>

Treaties between States could confer automatic right of access through internal waters to the ports of the coastal States concerned, but this would be dependent on the specific articles contained in the Treaty.

In South Africa, in terms of the Marine Traffic Act 1981, vessels engaged in normal maritime activities need not obtain permission to enter internal waters en route to harbours.<sup>932</sup> These vessels will have to comply however, with Port Authority Regulations while doing so. States have the right to deny access to any vessel or to close a port, normally open to international trade, should the State feel that there is a threat of any nature, or even the possibility of inconvenience, to the citizens of the State.<sup>933</sup>

Sweden has demarcated areas which are referred to as 'Restricted or Semi-Restricted Areas'. These areas are a combination of internal waters and territorial waters and are regarded by Sweden as being important in the event of Sweden engaging in warfare with another State or States. The regulations are of a military nature and refer not only to passage, anchoring or mooring in the areas, but to such activities as photography, drawing, printing or any other method of reproducing or describing Swedish installations.<sup>934</sup> In the event of a foreign vessel being in distress (*force majeure*) it has the right to enter internal waters, but it is subject to the authority of the coastal State and must comply with all instructions given to it, if it is able to do so.<sup>935</sup>

<sup>929</sup> D P O'Connell International Law Vol 2(1969) p869, Shaw n5 p42, 100-104

<sup>930</sup> Lotus Case n111

<sup>931</sup> LOSC Article 255

<sup>932</sup> DJ Devine "Sea Passage in South African Maritime Zones: Actualities and Possibilities" Law of the Sea Acta Juridica (1986) p203

<sup>933</sup> Brown n325 p38-40. Churchill n18 p52

<sup>934</sup> Swedish Code of Statutes, (1976) no 935 Article 25

<sup>935</sup> LOSC Article 18,

### *force majeure*

*Au sens large, tout événement imprévisible et insurmontable empêchant le débiteur d'exécuter son obligation; la force majeure est exonératoire.*<sup>936</sup>

*Superior force: an event or effect that cannot reasonably be anticipated or controlled.*<sup>937</sup>

In *The Creole*,<sup>938</sup> a slave trader, entered internal waters as a result of *force majeure*. It was held to be immune from the jurisdiction of the coastal State. This is relevant to-day. Ships in distress may retain immunity, regardless of the cargo carried, providing that the true cargo manifest is made available to the authorities of the coastal State. Should a vessel attempt to enter illegally and then finds itself in distress, it will not enjoy immunity.<sup>939</sup>

The status of a vessel that is no longer in distress and is still at anchor or that is in the process of leaving internal waters is unclear.<sup>940</sup>

On 30 June 1990 the master of the iron ore carrier, *Petingo*, which was en route to mainland China after loading cargo at Saldanha Bay, advised South African Port Authorities that fractures had occurred in the hull of the vessel during heavy weather. The vessel was, at that stage, approximately 400 nm south of Durban. The master reported that the 80 580 dwt vessel was in danger of sinking and requested permission to enter Durban harbour. The vessel had 40 crew members on board.<sup>941</sup>

It was found that as the draught of the vessel forward was down by 6 metres it was greater than could be accommodated in the port of Durban. The vessel was instructed to make for the Port of Richards Bay. The Port Authorities at Richards Bay advised that the only berth that could accommodate the vessel was occupied. The master of the *Petingo* therefore hove his vessel to off Richards Bay until the morning.<sup>942</sup>

When the pilot boarded the next morning, the forward draught had increased to 20 m, greater than the depth of 17,6 m at the berth. Waves were breaking over the forecastle and the situation was considered as serious. The Principal Officer of the Department of Transport instructed the master to steam to a position 50 nm offshore. The master, however, shut down his engine and the vessel grounded 4.5 miles off Durnford Point.

Salvors boarded the vessel and attempted salvage operations and anti-pollution vessels combated the bunker fuel that was discharged into the sea. The vessel was eventually a total loss.

Subsequent to the grounding, a Durban Magistrate found that the 61-year old Chinese master should have taken his vessel to sea and abandoned the vessel as requested by the Principal Officer. He was fined R30 000 for the pollution caused by the grounding. It was his last voyage after being master of vessels for 22 years.<sup>943</sup>

A number of questions need to be asked in regard to this incident.

- a) Did the master understand clearly and adequately the language in which the instructions were being given to him?

<sup>936</sup> Dalloz *Lexique de Termes Juridique* R Guillien & J Vincent (eds) 6<sup>th</sup> (Ed) (1985)

<sup>937</sup> *Websters Third New International Dictionary* (16<sup>th</sup> Ed) (1971)

<sup>938</sup> *Creole* (1853) Moore, Int. Arb. 4375

<sup>939</sup> Devine n919 p203-204

<sup>940</sup> *ibid*

<sup>941</sup> M Stuttford (ed) *South African Shipping News and Fishing Industry Review* (August 1990)

<sup>942</sup> *ibid*

<sup>943</sup> *ibid*



- b) Was any attempt made to assist the master while the vessel was overnight off Richards Bay?

Counsel for the master made two telling comments during the trial.

*Three days later and 30 minutes from safety, the port authorities ordered the stricken ship to head out to sea again. And*

*Captain Yui did not comply with the order (to proceed to sea) because he believed he was outside the port authority's jurisdiction.*<sup>944</sup>

The South African Transport Services (SATS) was the State Department responsible for operating all Government land, sea, and air transport services. This included harbours, and railway and airport facilities. When privatised as a Government owned private enterprise, Transnet, with subsidiaries such as Spoornet and Portnet, were given the same responsibilities.<sup>945</sup> While the difference in responsibilities between the Department of Transport and Portnet are now more clearly defined, it is debatable whether the instructions to the master of the Petingo, when his vessel was outside port limits and the roadstead were legal.

Counsel maintained that the master considered the crew of 40 aboard, the R6 million ship, the R4 million cargo and the bunkers, before allowing her to run aground on Durnford Shoal, the only safe shoal in the area. In spite of the court ruling, much discussion and a lot of sympathy for the master was generated by the incident. The most significant question that remains unanswered is did the port authorities offer the necessary support in a genuine case of force majeure and was the threat of pollution only an excuse to justify, retrospectively, this lack of support?<sup>946</sup>

A number of cases shed light on the obligations of the coastal State in a situation like this are.

Kate A Hoff (*The Rebecca*)<sup>947</sup>

Brig Concord<sup>948</sup>

The Creole<sup>949</sup>

Cushin and Lewis v R<sup>950</sup>

Carlo Alberto<sup>951</sup>

In Kate A. Hoff and Brig Concord the right of the coastal State to impose import duties or to be subject to arrest was considered to be included in the immunity that the vessels enjoyed as a result of their *force majeure* entry into internal waters.<sup>952</sup>

In the Creole Arbitration it was held that the coastal State had no right to release the slaves held aboard the vessel after she entered internal waters as a result of *force majeure*. Churchill and Lowe

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<sup>944</sup> *ibid*

<sup>945</sup> The Legal Succession to the South African Transport Services Act No 9 (1989) Section 11

<sup>946</sup> *ibid* p3

<sup>947</sup> The Rebecca (1929) IV RIAA 444

<sup>948</sup> Brig Concord Case (1815) 13 US 387

<sup>949</sup> Creole n925

<sup>950</sup> Cushin and Lewis v R (1935) L.R.Ex.C.R. 103, AD 1933-34 Case No 87

<sup>951</sup> Carlo Alberto (1832) *Sirey, Jurisprudence* I, 664

<sup>952</sup> Churchill n18 p51

feel however that it would be difficult to consider a coastal State not releasing slaves in present day circumstances.<sup>953</sup>

In Cushin and Lewis v R it was held that once vessels reached the relative calm of a port they should comply with the essential regulations, such as the reporting in of cargo.<sup>954</sup>

A coastal State may designate particular ports as international ports for the purposes of customs, excise, immigration and emigration. Where this has occurred, foreign vessels may not approach other ports of that State without permission, even while about normal business.<sup>955</sup>

In Carlo Alberto there is some authority for a vessel, forced to seek safety in a port that it had intended to enter illegally anyway, to be subject to local jurisdiction.

## ENFORCEABLE LAWS

Laws that are enforceable by the coastal State include those governing;

- a) pollution;
- b) seaworthiness of vessels;
- c) local crimes;
- d) civil liabilities;
- e) port and national navigational and transportation regulations.<sup>956</sup>

## Rights, Privileges and Obligations of a Flag State

In addition to the rights, privileges and obligations mentioned above, concerning entry into internal waters on normal business or as a result of *force majeure*, foreign State-owned vessels or warships enjoy additional immunity from local enforcement. LOSC defines a warship as follows;

*For the purposes of this Convention, 'warship, means a ship belonging to the armed forces of a State bearing the external marks distinguishing such ships of its nationality, under the command of an officer duly commissioned by the government of the State and whose name appears in the appropriate service list or its equivalent, and manned by a crew which is under regular armed forces discipline.'*<sup>957</sup>

Warships are accorded many immunities in internal and territorial waters, but they require permission or an invitation to enter internal waters. Once they are legally in internal waters, however, they are immune to the following actions without the permission of the officer commanding the warship.

- a) Police or port authorities may not board the ship and
- b) the ship may not be searched.<sup>958</sup>

While this is well-established customary law, and the warship is immune from enforcement jurisdiction, it is expected to comply with coastal State legislation such as harbour regulations.

<sup>953</sup> *ibid*

<sup>954</sup> Cushin and Lewis v R n937

<sup>955</sup> Churchill n18 p46

<sup>956</sup> *ibid* p47-48, 50

<sup>957</sup> LOSC Article 29

<sup>958</sup> BH Brittin International Law for Seagoing Officers 4th Ed (1981) p16

<sup>959</sup> The vessel is also expected to be handled, and the crew to behave, in a lawful manner. If this does not happen, the coastal State may request the ship to leave internal waters and the coastal State may then endeavour to seek compensation or retribution through diplomatic channels. <sup>960</sup> Similar privileges and immunities apply to public (State-owned) vessels not used commercially. <sup>961</sup>

While the crew of the warship are on official business ashore, they are equally immune to arrest and prosecution, but the status of crew on shoreleave is debatable. <sup>962</sup> The generally assumed method of dealing with offences committed while both on official business and on leave, is for the matter to be dealt with amicably by both the authorities of the coastal State and the officer commanding the warship. If this cannot be achieved then the diplomatic route is usually followed. Should a capital crime be committed by a member of the crew while on leave, it follows that the due process of law of the coastal State will take place. <sup>963</sup>

Should the Flag State waive immunity, however, the coastal State may try members of the crew of a warship for crimes committed aboard the warship in that State's territorial, or internal, waters. <sup>964</sup>

Should the entry of a warship occur without prior knowledge or permission, such as by a submerged submarine, then the recourse open to the coastal State is as follows:

- a) The vessel is told both to surface and to leave internal waters, or
- b) the coastal State acts in self-defence and takes whatever steps are necessary to protect its interests. <sup>965</sup>

This could mean that the foreign warship is forcibly ejected from internal waters where the incident has escalated into conflict. <sup>966</sup>

On 27 October, 1981, a Soviet submarine surfaced after grounding on a shoal, well inside Swedish territorial waters, which was also inside the military protected area of the Swedish Naval Base at Karlskrona. <sup>967</sup>

The Soviets requested permission to salvage the vessel, which the Swedish Government refused. The fact, that the captain of the vessel stated that the incident occurred as a result of navigational instrument failure, was given no credence by the Swedish Authorities, as he had been able to negotiate the treacherous archipelago surrounding the shoal without incident. <sup>968</sup>

The Swedish Authorities insisted that they would assist with the salvage of the vessel, on condition that the captain submit to interrogation by the Swedish authorities. The Soviets agreed to this and the vessel was subsequently salvaged and escorted out of Swedish territorial waters. The vessel had nuclear weapons on board. <sup>969</sup>

The circumstances were such, that it was obvious that the vessel was engaged in activities that could be to the detriment of Sweden. Although the submarine was in territorial waters without permission, had travelled through both territorial waters and internal waters while submerged, and could

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<sup>959</sup> *ibid*

<sup>960</sup> LOSC Article 30

<sup>961</sup> LOSC Articles 27-28

<sup>962</sup> Brittin n945 p16

<sup>963</sup> *ibid* p110

<sup>964</sup> *Chung Chi Cheung v Rex*(1939) A.C 160

<sup>965</sup> Churchill n18 p77

<sup>966</sup> Brittin n945 p106

<sup>967</sup> Churchill n18 p76

<sup>968</sup> *ibid*

<sup>969</sup> *ibid*

have been engaged in espionage activities, the Swedish Authorities could only have resorted to diplomatic protest as Sweden and the USSR were not at war.<sup>970</sup> Most States legislate against espionage, but espionage is not illegal in international law in peacetime or in war. States involved in conflict or war can make espionage punishable in municipal law.<sup>971</sup>

## TERRITORIAL WATERS

### Rights Privileges and Obligations of the Coastal State

LOSC provides for the rights of coastal States in its maritime zones but these rights do not affect the legal status of the superjacent waters and the airspace above these waters. Outside its territorial waters a coastal State may not infringe, in any way, on the navigational and other rights and freedoms of other States provided for in LOSC. In addition the coastal State is encouraged to adopt rules and regulations that give access, to its ports and harbours, to foreign research vessels engage in programmes that comply with Part XIII of LOSC.<sup>972</sup>

Rights of navigation are necessary for the safe passage of vessels engaged in internationally accepted trade. In addition, to the obligations that a State may have as a party to international conventions, customary law requires a coastal State to advise vessels in passage through its territorial waters of possible hazards and dangers to navigation. This duty exists both in customary law, as was recognised in the Corfu Channel Case and under treaty. This is not commonly known in southern Africa, as was indicated at the conference on maritime safety held in Maputo in 1995.<sup>973</sup>

Whether this coastal State obligation is as a result of being party to a convention or under customary law the implications for a coastal State are important.

### The Responsibilities of a Coastal State for Safe Navigation

International customary law requires a coastal State to provide the necessary navigational aids for vessels off its coast.<sup>974</sup>

Safe navigation has been facilitated by the advent of satellite systems of navigation such as GPS which have been advocated as possible worldwide navigation systems. This is a system under the control of the US Military. Its permanency during times of conflict cannot be assured. Debates on possible alternatives to GPS, or the reintroduction or continuing of terrestrial navigation systems have been continued at length.<sup>975</sup>

LOSC<sup>976</sup> requires a coastal State to give appropriate publicity to dangers in its territorial waters and to do this States party to LOSC must have a maritime safety information system or organisation. This service must be funded by the coastal State and they may not expect passing vessels to contribute to this service unless by agreement.<sup>977</sup> Foreign vessels that enter the ports of a coastal State may be subject to a levy that can then be used to subsidise the service. Coupled with this obligation is the attendant liability for errors of omission or commission.

A maritime safety information service includes publicity of dangers to navigation by coastal navigation warnings, NAVAREA warnings, which cover a wider area, and numerous publications such as Notices to Mariners, Lists of Lights and Radio Signals, Charts and Sailing Directions. To be

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<sup>970</sup> Swedish Government Statement March 16 1982, I Delupis "Foreign Warships and Immunity for Espionage".  
AJIL Vol 78 p53

<sup>971</sup> *ibid*

<sup>972</sup> LOSC Article 255

<sup>973</sup> Maputo Conference n777

<sup>974</sup> Churchill n18 p67, 84

<sup>975</sup> IALA RAD 1 Conference n616

<sup>976</sup> LOSC Article 24(2)

<sup>977</sup> LOSC Article 26

able to do this, a coastal State must have the ability to obtain the data or information or to contract this to a third party. The obligation and responsibility remains with the coastal State.

The Safety of Life at Sea Convention (SOLAS) obligates States party to it to;

arrange for the establishment and maintenance of such aids to navigation, including radio beacons and electronic aids, as, in their opinion, the volume of traffic justifies and the degree of risk requires, and to arrange for information relating to these aids to be made available to all concerned.<sup>978</sup>

### **Other Rights, Privileges and Obligations of the Coastal State in Territorial Waters**

The development of the rights of a coastal State in territorial waters has been discussed in earlier Chapters. It is evident that the conflict between the security of the coastal State and the rights of Flag States had to be resolved by conventions and by the practice of States. Prior to 1931 some writers and State practice inclined against 'absolute sovereignty' over territorial waters.<sup>979</sup> They referred to coastal States as having a 'bundle of servitudes'.<sup>980</sup>

The innocent passage of commercial vessels through territorial waters, appears to be acceptable to most States, either because the State is a party to LOSC or because it is considered to be customary law. In terms of LOSC, and relevant international conventions such as SOLAS, a coastal State may adopt laws and regulations relating to innocent passage of foreign vessels through its territorial waters.<sup>981</sup> The coastal State may prevent the passage of a vessel if it considers that it not innocent or that the passage is non-continuous and it may assume jurisdiction over such a vessel. The coastal State may impose its legislation on such a vessel or it may choose, by comity, not to.<sup>982</sup>

A positive list of legislation that a coastal State may apply exists in LOSC.<sup>983</sup> States may, however, adopt laws that prescribe technical standards relating to the construction of a vessel, its equipment or the manning of the vessel,<sup>984</sup> where both the coastal State and the Flag State are parties to an international convention such as the SOLAS Convention.<sup>985</sup> The coastal State may not, however, adopt laws that discriminate between States.<sup>986</sup>

Provisions in LOSC for criminal jurisdiction are also of interest.

*the criminal jurisdiction of the coastal State should not be exercised on board a foreign passing through the territorial sea.*<sup>987</sup>

It is noted that the phrase in this Article is 'should not' and not 'may not'. This indicates that the coastal State has full jurisdiction, but should apply comity. The injunction is in the negative, but the list contained, in this Article, gives the conditions under which a coastal State may act against a vessel in so-called innocent passage.<sup>988</sup>

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<sup>978</sup> UN Convention on Safety of Life at Sea (SOLAS) (1978) Chapter V Regulation 14

<sup>979</sup> Colombos n59 p87

<sup>980</sup> San Diego Law Review p574

<sup>981</sup> LOSC Article (21)(1), Brown n325 p61, Churchill n18 p73, Brittin n945 p84

<sup>982</sup> ibid

<sup>983</sup> ibid

<sup>984</sup> LOSC Article 21(2)

<sup>985</sup> SOLAS n965

<sup>986</sup> LOSC Article 24(1)(b)

<sup>987</sup> ibid, LOSC Article 27

<sup>988</sup> LOSC Article 27(1)(a)-(d)

## Right of Innocent Passage

Right of innocent passage in territorial waters and the freedom of navigation in exclusive zones and on the high seas are two of the most fundamental traditional rights that States have enjoyed for centuries. These have been considered in detail in Chapters I and IX. A simple definition of innocent passage is contained in the 1958 Geneva Convention on the Territorial Sea and the Contiguous Zone. This was given a more extensive definition in LOSC.<sup>989</sup>

Innocent passage was codified for the first time in the 1958 Geneva Convention on The Territorial Sea and the Contiguous Zone. It is included in LOSC with almost the same wording.

- 1) *Passage means navigation through the territorial sea for the purpose either of;*
  - a) *traversing the sea without entering internal waters, or calling at a roadstead or port facility outside internal waters; or*
  - b) *proceeding to or from internal waters, or a call at such roadstead or port facility.*
- 2) *Passage shall be continuous and expeditious. However, passage includes stopping and anchoring, but only in so far as the same are incidental to ordinary navigation or are rendered necessary by force majeure or distress or for the purpose of rendering assistance to persons, ships or aircraft in danger or distress.*<sup>990</sup>

As referred to in Chapter IX the status of warships in innocent passage is not very specific in LOSC nor in judgements of tribunals and courts. Neither Article 14(1) of the 1958 Convention nor Articles 17, 18 or 19 of LOSC distinguish between merchant vessels and warships. The inference is therefore clearly that warships have innocent passage through territorial waters without any pre-conditions. Later in this Chapter it will be seen, from the actions of States to which the US has objected, that many relate to the control of entry of warships into their territorial water. Permission to enter and controls imposed are usually achieved through diplomatic channels.

LOSC Article 19(2)(a)(b)(c) refer to the use of force against the coastal State, the practice of weapons, and the landing or take-off of aircraft or military devices. It is considered that warships are the most likely vessels to conduct these types of operations and their right of innocent passage could be compromised.

LOSC lists the following actions that constitute a possible threat to a coastal State and which may render the passage non-innocent

- a) any actions considered a threat to the coastal State or in contravention of the principles of international law embodied in the Charter of the United Nations;
- b) the exercising of weapons;
- c) the collecting of intelligence information prejudicial to the coastal State;
- d) the promotion of propaganda prejudicial to the defence of the State; &
- e) the launching and taking on board of any aircraft
- f) the launching or taking on board of any military device;
- g) the loading or unloading of any commodity, currency or person contrary to the customs, fiscal, immigration or sanitary laws and regulations of the coastal State;

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<sup>989</sup> LOSC Articles 17-25

<sup>990</sup> LOSC Article 18

- h) pollution;
- i) fishing;
- j) research activities;
- k) interference in the communications of the coastal State;
- l) activities with no direct bearing on continuous passage through the territorial waters.<sup>991</sup>

The rules of the coastal State, where they meet international standards should be obeyed.

LOSC provides for warship compliance with coastal State legislation in territorial seas as follows:

*If any warship does not comply with the laws and regulations of the coastal State concerning passage through the territorial sea and disregards any request for compliance therewith which is made to it, the coastal State may require it to leave the territorial sea immediately.*<sup>992</sup>

While it has been historically possible to resolve, in most instances, the passage of unarmed merchant vessels, the major consideration of coastal States has been the passage of warships, their conduct and whether permission to pass through territorial waters has to be sought or obtained.<sup>993</sup> The major case dealing with the passage of foreign warships, the Corfu Channel Case<sup>994</sup> resolved the situation of foreign warships passing through straits, but it did not consider the rights and obligations of foreign warships in territorial waters. Foreign submarines must navigate the territorial waters of another State on the surface and show their flag.<sup>995</sup>

The right of innocent passage may be temporarily suspended by a coastal State. The State may suspend temporarily in specified areas of its territorial sea or archipelagic waters, provided that due publicity has been given to the suspension.<sup>996</sup> Innocent passage through straits may not be suspended.<sup>997</sup>

Brown concludes that in accordance with the Geneva Convention on the Territorial Sea and the Contiguous Zone coastal States may not insist on prior permission being given or even for notification of the passage of a foreign warship through territorial waters. Reservations purporting to preserve such rights for a coastal State are void and incompatible with the objects and purposes of the Convention. He feels further that LOSC does not confer such rights on a coastal State and no statements or declarations to that effect have been made by States Party when signing, ratifying or acceding to LOSC.<sup>998</sup> The actions of both States Party and non-party States, (Pages 236-239) have indicated that this issue is far from resolved.

Akehurst lists seven rights of a coastal State in territorial waters, many of which are of direct concern to navigation.

<sup>991</sup> LOSC Article 19, Churchill n18 p67 & 274, WT Burke "Contemporary Developments Affecting Navigation Rights in Law of the Sea" in Clingan n741 p145

<sup>992</sup> LOSC Article 30, Brittin n945 p106, Starke n763 p265

<sup>993</sup> Brittin n945 p101

<sup>994</sup> Corfu Channel Case ((1949) ICJ Rep 1)

<sup>995</sup> LOSC Article 20, Churchill n18 p70, Brittin n945 p83

<sup>996</sup> LOSC Article 25(3) and 52(2)

<sup>997</sup> LOSC Article 25(3) O'Connell n47 p297-298

<sup>998</sup> Brown n325 p72

- a) The right to mobile and non-mobile resources of the territorial sea and its seabed and subsoil is exclusively that of the coastal State.
- b) The air-space over the territorial sea is exclusively the coastal State's. No right of innocent passage exists in the case of aircraft.
- c) Cabotage, the right to transport goods and passengers from one part of the coastal State to another of the coastal State, is exclusively the right of the coastal State.
- d) If the coastal State is neutral in a dispute or a conflict other States may not engage in acts of war or interfere with merchant shipping in the territorial waters of the neutral State.
- e) The coastal State may enforce legislation dealing with navigation, health, customs and excise and immigration and emigration.
- f) Certain powers of arrest exist in the case of merchant vessels, even though they may be in innocent passage. This applies to persons aboard the vessel as well. Warships are immune from this legislation, but may be told to leave territorial waters should the coastal State be dissatisfied with the conduct of the warship or its crew.
- g) Akehurst feels that in terms of customary law the coastal State has the right to try crimes committed aboard foreign vessels in their territorial waters but the Flag State would have concurrent jurisdiction.<sup>999</sup>

LOSC however is more specific. A coastal State may enforce criminal jurisdiction on foreign vessels in its territorial waters if;

- a) the consequences of the crime extend to the coastal State,
- b) the crime will disturb the peace of the coastal State or the good order of its territorial waters,
- c) the master of the vessel has requested assistance,
- d) the measures are necessary to combat drug or psychotropic substances.<sup>1000</sup>

The coastal State may enforce criminal jurisdiction law against a vessel in territorial waters, if the vessel has exited from its internal waters. The coastal State is expected to advise the vessel's diplomatic agent or consular officer about actions taken against the vessel if the master so requests.<sup>1001</sup>

The coastal State may not take action for offences occurring before the vessel entered territorial waters. At all times the actions of the coastal State should have due regard in the interests of safe navigation.<sup>1002</sup> Other than where a vessel is passing through territorial waters after having been in that State's internal waters, the coastal State does not enjoy the same rights with regard to civil jurisdiction.<sup>1003</sup>

<sup>999</sup> Akehurst n10 p172-3

<sup>1000</sup> LOSC Article 27(1), Devine n919 p211

<sup>1001</sup> *ibid*

<sup>1002</sup> LOSC Article 27

<sup>1003</sup> LOSC Article 27(5)



The coastal State may not interfere in the passage of the vessel or levy execution against the vessel or anyone aboard for civil obligations or liabilities, other than those incurred by the vessel while in the territorial waters of the State.<sup>1004</sup>

Some States require a vessel in innocent passage to fly the colours of its Flag State. This is considered normal procedure. In 1958 the Indonesian Navy arrested a British vessel, *Moon Breezes*, for failure to fly the British flag in their territorial waters.<sup>1005</sup>

In a South African context, ministerial powers exist over ships that do not fulfil the requirements of innocent passage. They include the right to stop the ship, to detain it and for the seizure and disposal of the ship and/or the cargo. These powers do not exist in the case of foreign warships or public ships not used for commercial purposes.<sup>1006</sup>

States parties to conventions related to navigation are obliged to comply with them. In terms of these conventions, coastal States have the right to enforce national legislation that gives effect to them. This does not normally relate to the construction of the vessel or its manning. If it is considered, however, that the vessel poses a threat to the coastal State then the coastal State may enforce all legislation pertaining to ship safety.<sup>1007</sup>

While a coastal State must refrain from impairing the right of a vessel to innocent passage, it is entitled to insist that these vessels use designated sea-lanes.<sup>1008</sup> These sea-lanes or traffic-separation schemes should take into account traffic density and the safety of navigation of the vessels.<sup>1009</sup>

The vessels that cause the main concern are laden tankers, nuclear powered vessels and vessels carrying nuclear material or waste.

### Traffic-Separation Schemes

Provision is made in LOSC<sup>1010</sup> for a coastal State to introduce traffic-separation schemes in territorial waters, archipelagic waters and straits. These should not interfere with innocent passage and the scheme should be introduced in the interests of safe navigation. There are at present over ninety routing schemes in operation worldwide.<sup>1011</sup> While the International Maritime Organisation (IMO) is recognised as the only international body competent to approve traffic-separation schemes,<sup>1012</sup> coastal States have certain rights in terms of the Territorial Sea Convention, Article 17 and LOSC<sup>1013</sup> to prescribe these zones in their territorial waters.

IMO has drafted specific guidelines for the establishment of traffic-separation schemes and a coastal State is required to obtain IMO approval for a scheme before implementing the scheme in its national legislation. These schemes must receive due publicity and should be indicated on the nautical charts of the coastal State.<sup>1014</sup> The proposals are considered yearly by the IMO.

Approximately twenty years ago, South Africa introduced a traffic-separation scheme<sup>1015</sup> but this was never enforced. It had no legal status as it had not been submitted to the IMO nor was it

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<sup>1004</sup> LOSC Article 28

<sup>1005</sup> Brittin n945 p84

<sup>1006</sup> Devine n919 p207

<sup>1007</sup> ibid

<sup>1008</sup> ibid

<sup>1009</sup> ibid

<sup>1010</sup> LOSC Article 22, Churchill n18 p187, Brittin n945 p84

<sup>1011</sup> Churchill n18 p187

<sup>1012</sup> SOLAS n965 Chapter V Reg 8(b)

<sup>1013</sup> LOSC Article 22(1)

<sup>1014</sup> LOSC Article 211(6)(b)

<sup>1015</sup> SA Notices to Mariners No 3 (1970)

included in national legislation. A scheme for southern Africa was approved by the Maritime Safety Committee of the International Maritime Organisation in December 1998.<sup>1016</sup>

An unusual situation exists off the south coast of South Africa, where the Winter and Summer Load Line boundary has been diverted around the southernmost portion of the African continent. This boundary-line passes just south of Six Mile and Twelve Mile Banks, and over the Alghard Banks. Charted depths over these banks are 22 m, 26m, and 15,5 m respectively.<sup>1017</sup>

In addition, an oil-production platform has been erected just south of the boundary, with a submarine pipeline between the platform and the mainland to the north.<sup>1018</sup>

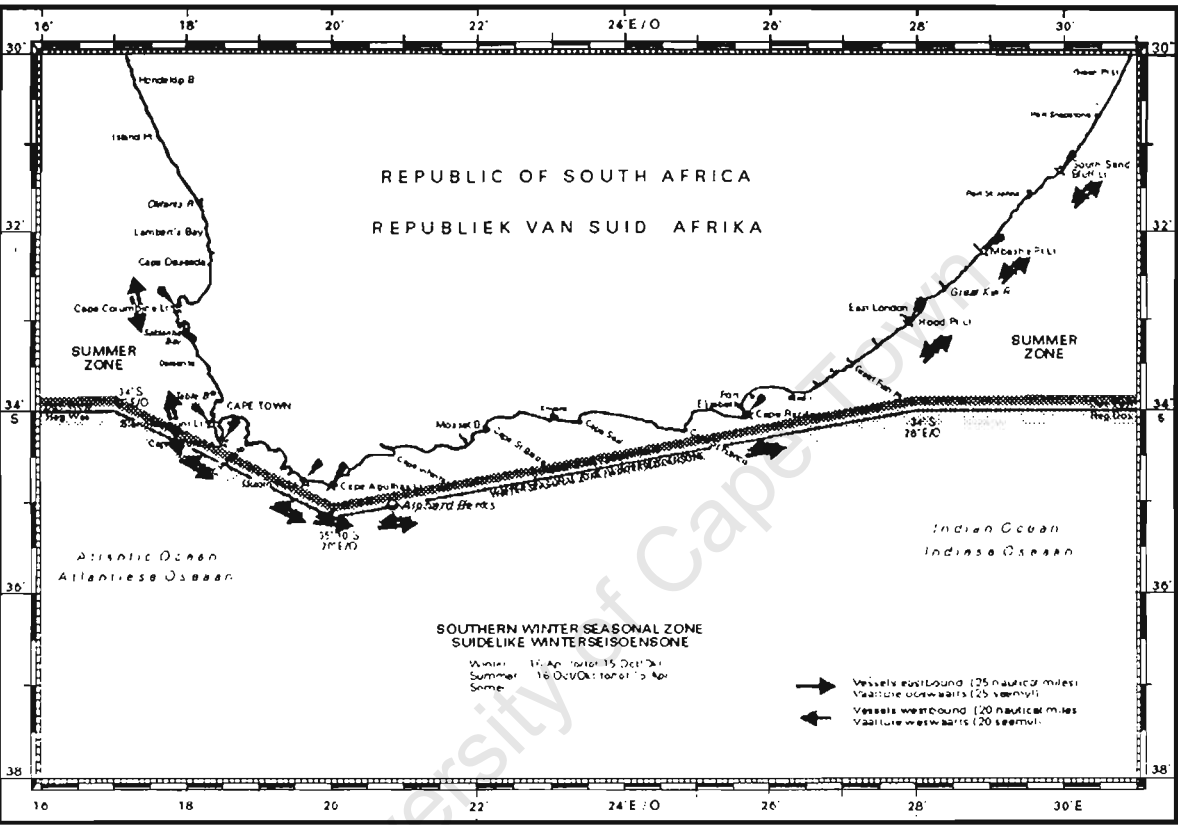


Figure 64 THE POSITION OF THE WINTER/SUMMER LOADLINE BOUNDARY AROUND SOUTHERN AFRICA

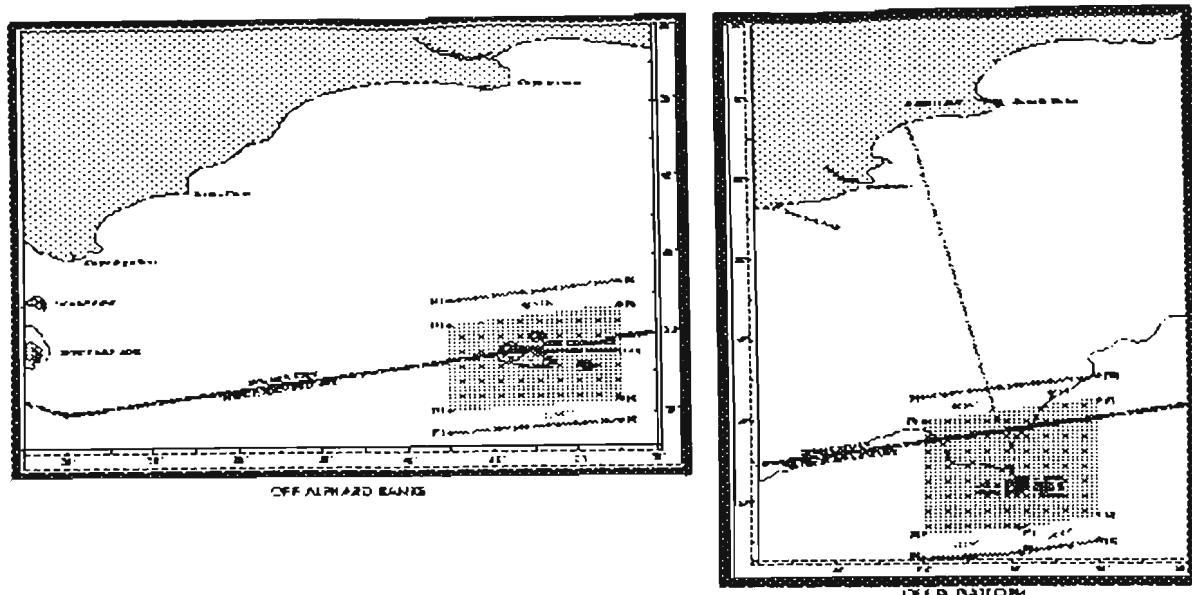
East-bound tankers are usually unladen, while west-bound tankers are laden. In the interests of safe navigation a local requirement has been promulgated for east-bound tankers to pass 25 nm off the promontories in the area and west-bound tankers 20 nm.<sup>1019</sup>

<sup>1016</sup> Report of the IMO Maritime Safety Committee Meeting MSC 70 MSC 70/23 (December 1998)

<sup>1017</sup> SAN Annual Notices to Mariners (December 1995) p16

<sup>1018</sup> ibid

<sup>1019</sup> ibid p16-17



**Figure 65 A TRAFFIC-SEPERATION SCHEME AROUND AN OIL-PRODUCING RIG AND A HAZARDOUS SHOAL IN THE REGION OF THE LOADLINE BOUNDARY**

The introduction of the oil production platform has necessitated a traffic-separation scheme around the platform and compromised the shipping companies with regard to the loading of their vessels in the Winter and Summer Load Line areas.

The easiest solution would be to move the Load Line boundary further to the south. This would protect the vessels and the platform and not compromise the interests of trade. As the boundary forms part of the UN Convention on Load Lines (London) (1966),<sup>1020</sup> it would be extremely difficult to amend this boundary.

In addition to the 1958 Geneva Conventions and LOSC, a number of conventions, designed to facilitate safety of navigation, are in force. If a coastal State is a party to one, or all, of these conventions, it may have obligations in its maritime zones or on the high seas. The conventions that are specific to States, or particular areas and that are in force, appear at the end of this Chapter, with the dates that they came into force.

#### **Rights, Privileges and Obligations of the Flag State (other than innocent passage)**

A Flag State has the right to take whatever actions are necessary to protect its vessels in innocent passage from attack. This is illustrated by the Mayaguez incident which occurred on 12 May 1975. The Mayaguez, a US commercial vessel employed in normal trade, en route from Hong Kong to Singapore, was steaming between six to seven miles off Puolo Wai Island, which is about fifty miles off the coast of Cambodia. Cambodia claims a twelve nautical mile territorial sea, and mistakenly or intentionally, decided that the US vessel's intentions were not innocent. Cambodian gunboats fired upon the vessel, boarded and seized it. In spite of intensive diplomatic initiatives, no acceptable responses were received by the US Government. US Marines, warships and aircraft were used to secure the release of the vessel.<sup>1021</sup>

In contrast, the International Court of Justice severely criticised the British Government for its actions in the Corfu Channel. In November 1946, as a result of its vessels being damaged by mines laid in Albanian territorial waters, the British conducted minesweeping operations in the Channel, on 12 and 13 November, to secure the *corpora delicti*.

<sup>1020</sup> UN Convention on Load Lines (London) (1966)

<sup>1021</sup> Brittin n945 p83/84

The Court held as follows.

*The Court can only regard the alleged right of intervention as the manifestation of a policy of force, such as has, in the past, given rise to most serious abuses and such cannot, what ever be the present defects in International Organisation, find place in International Law. Intervention is perhaps still less admissible in the particular form it would take here; for, from the nature of things, it would be reserved for the most powerful States, and might easily lead to perverting the administration of international justice itself.*<sup>1022</sup>

## BEYOND TERRITORIAL WATERS

### Freedom of Navigation

Freedom of navigation is defined in the 1958 Convention as;

*The high seas being open to all nations, no state may validly purport to subject any part of them to its sovereignty.....*<sup>1023</sup>

Freedom of navigation outside of territorial waters was always regarded as a right in international customary law.<sup>1024</sup>

In 1932, however, Counsel for the Government of Canada Croft v Dunphy,<sup>1025</sup> a case dealing with the validity of the Customs Act of Canada, authorising the seizure of vessels, stated;

*But whatever be the limits of territorial waters in the international sense, it has long been recognised that for certain purposes, notably those of police, revenue, public health, and fisheries, a State may enact laws affecting the seas surrounding its coasts to a distance seaward which exceeds the ordinary limits of its territory.*<sup>1026</sup>

On 23 January 1924, during the era of Prohibition in the United States, the Governments of the United States and Great Britain (UK) signed The Convention for the Prevention of Smuggling of Intoxicating Liquors.<sup>1027</sup> Article I of this Treaty recognises the 3 nm territorial limit of the US, but in Articles II (1)-(3) the OUR agreed to allow the boarding of vessels on its register, to ascertain whether the vessel was engaged in attempting the importation of any form of illegal alcoholic beverage to the US. This could take place within the area demarcated by the limit that the vessel could steam in one hour from the outer limits of the territorial waters of the US. This Treaty was, strangely, not terminated when the Eighteenth Amendment to the US Constitution, dealing with prohibition was abrogated. In general, prior to the introduction of exclusive economic and fishing zones, the harvesting of mobile resources, outside of territorial waters, had also been accepted as being a basic right of all States.<sup>1028</sup>

Technological developments have made it possible for far greater use to be made of the resources found in the sea, whether close to a coast, or in and under the high seas. One of the major economic

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<sup>1022</sup> Corfu Channel Case n983

<sup>1023</sup> High Seas Convention n26 Article 2

<sup>1024</sup> Chapters III & IX

<sup>1025</sup> Croft v Dunphy n157

<sup>1026</sup> *ibid*

<sup>1027</sup> Convention for the Prevention of Smuggling of Intoxicating Liquors. 43 Stat. 1761; USTS 685; Trenwith, (1938) 4225; 27 LNTS 182

<sup>1028</sup> Fulton n60 p2-3

factors of coastal States relate to the exploration, exploitation and conservation of their marine resources.<sup>1029</sup>

Freedom of navigation imposes no restriction on the vessel except that it should not be engaged in either piracy or slave trading and the vessel may not participate in research, exploration or exploitation in the exclusive economic zone of a coastal State without that State's permission.<sup>1030</sup> Ships engaged in piracy may be apprehended by any State.<sup>1031</sup> A State may only inform the Flag State of a vessel about its slavery activities outside territorial waters.<sup>1032</sup>

The 1958 Conventions and LOSC endeavour to ensure that the traditional freedoms are not interfered with. Whereas the historical concern was for a Flag State to be assured of free access for its vessels to trade internationally, the coastal State was concerned with security. The situation prevailing in the world today has changed these concerns considerably. The range of weaponry has increased beyond comprehension, the resources of the sea, the seabed and the subsoil have great potential and the threat of pollution from oil and toxic waste is such that all States are concerned for the well being of the high seas and the seabed thereunder.

Although there now appears to be general agreement amongst States on the freedom of the high seas concept, this was not always the case in the recent past.<sup>1033</sup>

In 1958, the United States proposed a compromise solution for the breadth of the territorial seas, which had reached an impasse. The US proposal of a 6 nm wide territorial sea with a further 6 nm as a fishing zone received support, but not enough to attain the necessary 2/3 majority.<sup>1034</sup> The breadth of the territorial sea was therefore only agreed upon at the LOSC Conference completed in 1982. LOSC came into force on 16 November 1994.

Foreign warships enjoy the same freedom of navigation as merchant vessels and may conduct naval manoeuvres in the area providing that the interests of the coastal State and the international community are not threatened.<sup>1035</sup>

LOSC requires that the exclusive economic zones and the high seas should be reserved for peaceful purposes.<sup>1036</sup> It is debatable whether weapons exercises involving the discharge of these weapons is regarded as a peaceful purpose and whether it is acceptable in international law. Some writers feel, however, that such uses on the high seas have been lawful in the past and that they should be considered as peaceful. It is unsure whether warships may engage in weapons exercises in the exclusive economic zone of another State.<sup>1037</sup>

The actions of the United Kingdom affecting freedom of navigation during the Falklands War illustrate the predicaments that can arise when a self-defence situation occurs in an area.<sup>1038</sup> The Argentineans occupied the islands of South Georgia and the Falklands during 1982. On the 12 April, the UK imposed a 200 nm exclusion zone around the Falklands for Argentinean naval ships.<sup>1039</sup> The Argentineans were warned that any incursion into this zone would be considered as a threat to the British Forces reoccupying the islands. On 30 April, a total exclusion zone was imposed and Argentina was advised that any ship or aircraft, coming into the zone and acting in support of the

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<sup>1029</sup> LOSC Article 58

<sup>1030</sup> LOSC Article 38(2) & 105

<sup>1031</sup> LOSC Articles 101-107, Churchill n18 p149, Brittin n945 p101-103

<sup>1032</sup> LOSC Article 99, Brown n325 p310, Churchill n18 p150

<sup>1033</sup> *ibid* p59-62

<sup>1034</sup> Akehurst n10 p173-174

<sup>1035</sup> LOSC Article 59

<sup>1036</sup> LOSC Article 59, 58 and 88

<sup>1037</sup> Churchill n18 p134 & 311

<sup>1038</sup> United Nations Charter Article 51

<sup>1039</sup> British Admiralty Notice to Mariners (12 April 1982)

Argentinean occupation, would be regarded as hostile. Freedom of navigation was therefore suspended in this 200 nm zone to all such vessels. This zone bordered on the 12nm Argentina territorial sea and, with exception of strong protests from Argentina and a protest from Panama, the USSR and the Organisation of Consultation of the Inter-American Treaty of Reciprocal Assistance, no other State objected or commented on this imposition. Even after the islands were reoccupied the British maintained a 150 nm protection zone around the island.<sup>1040</sup>

### **Navigational Issues in the Exclusive Economic Zone**

In accordance with Article 58(1), freedom of navigation and overflight exists in the exclusive economic zones, States may lay pipelines, submarine cables and enjoy other uses of the sea in an exclusive economic zone<sup>1041</sup> provided that they have due regard for the rights, laws and regulations of the coastal State and for the freedom of navigation.<sup>1042</sup> The coastal State has the sole right to construct, or to authorise the construction of, installations and artificial islands in its exclusive economic zone.<sup>1043</sup> The coastal State also has exclusive jurisdiction over all structures in its exclusive economic zone<sup>1044</sup> including jurisdiction on the structures over customs, fiscal, health, safety and immigration matters.<sup>1045</sup>

In the interests of safe navigation due notice must be given of the construction of such installations and they should have a permanent means of warning mariners of their presence.<sup>1046</sup> Safety zones may be declared around the structures in the interests of the safety of both the structure and of navigation.<sup>1047</sup> The breadth of the safety-zone may not exceed 500 metres from the outermost points of the structure in any direction.<sup>1048</sup> It is not clear whether anchors and kedges laid on the seabed as a part of the mooring system for the installation can be considered as the outermost points. If this is the case then the positions of these ground tackles would have to be buoyed.<sup>1049</sup> While shipping is expected to take the necessary steps to avoid the structures, it is also beholden on the coastal State not to erect, where possible, these structures in recognised international sealanes.<sup>1050</sup>

When a structure is no longer required, it should be removed, in accordance with acceptable international practice.<sup>1051</sup> Where the entire structure is not removed, it should be treated as a danger to navigation and the coastal State is obligated to give due notice of its position, depth, and dimensions.<sup>1052</sup>

During 1989, the South African Hydrographic Office was advised by the Southern Oil Exploration Corporation, (SOEKOR) now known as SOEKOR, that dry oil wells, when abandoned, retained a substantial steel structure 5 metres high on the seabed. One hundred and forty one of these wells exist but, as they are in relatively deep water, they do not constitute a threat to normal navigation. They did, however pose a threat to fisherman engaged in bottom trawling. Notice was then given of their positions, the dimensions of the structures and approximate depth of water. Most of these wells are found within distances of 120 nm from the coast, in South Africa's exclusive economic zone.

<sup>1040</sup> S A Riesenfeld "High Seas and Navigational Rights: What are they and who may assert them in US Courts", Proceedings of the 20<sup>th</sup> Annual Conference of the Law of the Sea Institute Miami (1986) p42

<sup>1041</sup> LOSC Article 58 (1)

<sup>1042</sup> LOSC Article 58 (3)

<sup>1043</sup> LOSC Article 59(1)(a)

<sup>1044</sup> LOSC Article 59(1)(b)(i)

<sup>1045</sup> LOSC Article 60(2)

<sup>1046</sup> LOSC Article 60 (1)(2), Churchill n18 p131, Brittin n945 p137

<sup>1047</sup> LOSC Article 60(4), Churchill n18 p147/184

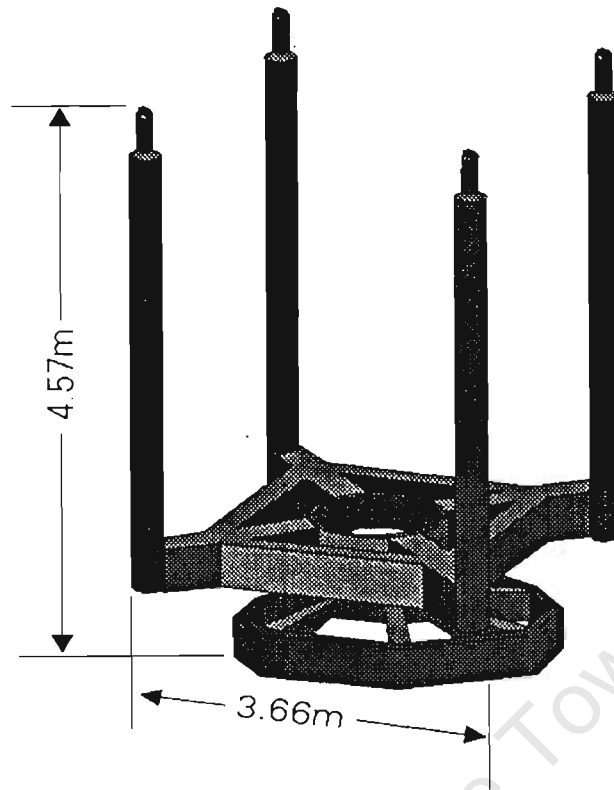
<sup>1048</sup> LOSC Article 60(5)

<sup>1049</sup> LOSC Article 60(5), Brittin n945 p130-137

<sup>1050</sup> LOSC Article 60(2)

<sup>1051</sup> LOSC Article 60(3)

<sup>1052</sup> *ibid*



**Figure 66 WELL-HEADS SOMETIMES LEFT ON THE SEABED WHEN DRILLING IS ABANDONED**

### Piracy

Piracy is defined as:

*Piracy consists of the following acts:*

- (a) *any illegal acts of violence or detention, or any act of depredation, committed for private ends by the crew or the passengers of a private ship or a private aircraft, and directed*
  - i) on the high seas against another ship or aircraft, or against persons or property on board such ship or aircraft;*
  - ii) against a ship aircraft, persons or property in a place outside the jurisdiction of any State;*
- (b) *any act of voluntary participation in the operation of a ship or of an aircraft with knowledge of facts making it a pirate ship or aircraft;*
- (c) *c) any act of inciting or of intentionally facilitating an act described in subparagraph (a) or (b).*<sup>1053</sup>

There are no non-legal considerations of a technical or scientific nature involved in acts of piracy.

### Pirate (Unauthorised) Broadcasting

*For the purpose of the Convention, 'unauthorised broadcasting' means the transmission of sound, radio or television broadcasts from a ship or installation on the high seas, intended for reception by the general public contrary to international regulations, but excluding the transmission of distress calls.*<sup>1054</sup>

<sup>1053</sup> LOSC Article 101

<sup>1054</sup> LOSC Article (2)

LOSC provides for extensive control of illegal broadcasting by a coastal State on the high seas.<sup>1055</sup> This provision allows for the prosecution of a person engaged in unauthorised broadcasting by;

- a) the Flag State of the ship;
- b) the State where the installation is registered;
- c) the national State of the person involved;
- d) any State where the transmission is received;
- e) any State suffering interference as a result of the transmission.

### **Slave-Trading**

There are no non-legal considerations of technical or scientific nature involved in slave-trading and thus the topic, like piracy, will not be further discussed.

### **Landlocked States and Navigation**

The situation regarding the rights of landlocked States and their transit States will be considered in greater detail in Chapter X which deals with resources and the sharing of resources. The definition as given in LOSC<sup>1056</sup> is that a landlocked State is a State that does not have a sea-coast. In terms of LOSC, transit States are obliged to enter into bilateral agreements with the landlocked States in regard to the facilities and the movement of goods from the ports of the transit State to the landlocked State.<sup>1057</sup>

In accordance with the provisions of LOSC landlocked States and geographically disadvantaged States may participate in the excess fish stocks found in the exclusive economic zone of a coastal State. It is possible therefore that vessels from these and possible other States may enjoy navigation and communications rights within the zones of the coastal State.<sup>1058</sup>

The concerns of the coastal State in regard to rights of landlocked States are in the following areas;

- a) access to the ports and facilities of the coastal State by vessels of a landlocked State or its agents;
- b) the activities of these vessels while in the process of exercising their right of access to surplus stocks

*land-locked States shall have the right of access to and from the sea for the purpose of exercising the rights provided for in this Convention including those relating to the freedom of the high seas and the common heritage of mankind. To this end, land-locked States shall enjoy freedom of transit through the territory of transit States by all means of transport.*<sup>1059</sup>

The transit State must, where possible, make available to the land-locked State all port, customs and transport facilities that are available, with the minimum of delays, and the transit State must accord vessels of the land-locked State the same rights and privileges accorded other foreign vessels.<sup>1060</sup>

This is qualified by the requirement in LOSC that this freedom shall be exercised within bilateral or regional agreements between the land-locked and transit States.<sup>1061</sup> In southern Africa there are six such States: Lesotho, Swaziland, Botswana, Zimbabwe, Zambia and Malawi. Any State between these States and the sea that is party to LOSC can be considered a 'transit State'. As the transport infrastructure of the majority of States in the region would be unable to cope with the requirements of these land-locked States, it would appear that the land-locked States would look to the RSA as the major transit State of the region.

<sup>1055</sup> LOSC Article 109, Churchill n18 p150

<sup>1056</sup> LOSC Article 58(1), N R Guy "Policy Issues Arising from the Entry into Force of the Law of the Sea Convention National Maritime Conference Cape Town (1994)

<sup>1057</sup> LOSC Articles 125-132

<sup>1058</sup> LOSC Article 58

<sup>1059</sup> LOSC Article 125 (1)

<sup>1060</sup> LOSC Articles 126, 127 and 131

<sup>1061</sup> LOSC Article 125 (2)



Should the RSA become a Transit State, in accordance with LOSC, the number of landlocked States claiming transit rights would be very significant. The transport infrastructure and facilities in southern Africa, other than the RSA and Namibia, are in serious need of upgrading.<sup>1062</sup> The road and rail facilities are very substandard and the state of port and port-approach hydrographic surveys has resulted in a serious reluctance on the part of the international maritime industry to trade through these ports.<sup>1063</sup> In many cases aids to navigation, in the forms of buoys and lighthouses, are non-existent and maritime safety information is either not transmitted at all or on a very irregular basis.<sup>1064</sup>

Very little commerce or trade is possible through ports which are, probably, only capable of meeting the requirements of the coastal State itself. The benefit therefore for land-locked States, adjoining these coastal States, to consider them as transit States would be minimal. South Africa, however, has 11 of the 14 main ports and these ports are operating well and the transport infrastructure in the country generally is of a high standard.<sup>1065</sup> Any State Party situated between a land-locked State and the sea can be regarded as a transit State regardless of whether it adjoins that State or not. Should the RSA ratify LOSC it could be expected to act as the transit State for all six land-locked States in the region and its transport and port facilities would be placed under extreme pressure.

### Communication Rights of Landlocked States

- a) Transit State means a State with or without a sea-coast situated between a landlocked State and the sea, through whose territory traffic in transit passes.
- b) Traffic in transit means transit of persons, baggage, goods and means of transport across the territory of one or more transit States, when the passage across such territory, with or without transshipment, warehousing, breaking bulk or change in the mode of transport, is only a portion of a complete journey which begins or terminates within the territory of the landlocked State.
- c) Means of transport means;
  - i) railway rolling stock, sea, lake, and river craft and road vehicles;
  - ii) where local conditions so require, porters and pack animals,<sup>1066</sup> access to ports.
  - iii) transport services, customs and excise duties, right of innocent passage, freedom of navigation and overflight, and the laying and maintaining of pipelines and cables.<sup>1067</sup>

In accordance with LOSC, international organisations that intend undertaking research in the Area have to advise the landlocked and geographically disadvantaged States as well as the coastal States.<sup>1068</sup> The landlocked States may also participate in the research programmes and they are entitled to the results of the research conducted.<sup>1069</sup> It is estimated that there are only 30 States that have no sea coast out of approximately 190 States. 14 of these landlocked States are in Africa,

<sup>1062</sup> IHO/IALA Study Team Report n777 p1

<sup>1063</sup> W Dernier "Requirement of Shipping and Other Interests for Navigation Services" Proceedings of the Maputo Conference n777 p33

<sup>1064</sup> *ibid*

<sup>1065</sup> N Oosthuisen "Ports and their Hinterlands within Southern African Ports" Proceedings of the National Maritime Conference

<sup>1066</sup> LOSC Article 124(1), 125(2) & (3)

<sup>1067</sup> LOSC Article 58

<sup>1068</sup> LOSC Article 254(1)

<sup>1069</sup> LOSC Article 254 (3)(4)

nine in Europe, five in Asia and two in Latin America. Of the 14 landlocked States in Africa five, possibly six, of these States will regard the RSA as a transit State in terms of LOSC.<sup>1070</sup>

Landlocked States enjoy the same rights of innocent passage through the territorial waters of coastal states even though they may not be a coastal State.<sup>1071</sup> This would be of little value to a landlocked State if it were to be denied access to the ports of the coastal State.<sup>1072</sup> They are entitled to the freedom of the high seas to exercise all the activities listed in Article 87 and the right to sail vessels under its flag on the high seas.<sup>1073</sup> At present the only landlocked States that operate merchant fleets under their own flag are Austria, Bolivia, Czech Republic, Slovakia, Hungary, Mali, Paraguay, Switzerland and Uganda. It is unlikely that more landlocked States in Africa will be in a position to operate fleets of any consequence for some time.<sup>1074</sup>

## Questions Affecting All Maritime Areas

### Open Registers

A major concern of coastal States has been the practice of flags of convenience. The 1958 Convention on the High Seas declares that a vessel must have a genuine link with the State where the vessel is registered.<sup>1075</sup> This Article is reputed to have arisen from the 1955 International Court of Justice judgement in the *Nottebohm Case*.<sup>1076</sup> Regrettably this has not been successfully complied with and the tonnage of vessels registered on these open lists multiplied many times in the years succeeding 1958. It is estimated that most of the world shipping tonnage is registered in Panama, Singapore, Cyprus and Somalia. There are approximately 50 major international conventions and protocols to these conventions that deal with shipping and navigation. Panama, Singapore and Cyprus are parties to the majority of these, with the exception of those that deal with compensation and contributions to international funds to offset damages.<sup>1077</sup> Somalia is party to only two, the IMO and the Load Lines Conventions.<sup>1078</sup>

The 1958 Convention Article is repeated in LOSC.<sup>1079</sup> The Convention on the Conditions of Registration of Ships was adopted in Geneva in February 1986. This convention was intended to correct the lack of effect that both the 1958 High Seas Convention and LOSC have had on the introduction of the 'genuine link' requirement between a vessel and its Flag State.<sup>1080</sup> It is difficult to understand why those States with open registers would become party to such a convention, as they would deny themselves a lucrative source of income. There is equally little inducement for ship owners to register their vessels in a State that would be a party to the Convention.<sup>1081</sup> Even if the Flag State is party to LOSC it still requires a high level of co-operation by that State for the control of open registers to be meaningful. It is possible that one of the reasons for the adoption of this Convention was the hope that a reduction in the size of the open registry would encourage the development of national fleets amongst the developing States. In the period of time since the adoption of the

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<sup>1070</sup> Churchill n18 p278

<sup>1071</sup> LOSC Article 17

<sup>1072</sup> Churchill n18 p280

<sup>1073</sup> LOSC Article 90

<sup>1074</sup> Churchill n18 p279

<sup>1075</sup> High Seas Convention n26 Article 5

<sup>1076</sup> *Nottebohm Case* (1955) ICJRep.4

<sup>1077</sup> IMO's web site *Summary of Status of Conventions* (1 June 1998)

<sup>1078</sup> Chapter XIII

<sup>1079</sup> "...There must be a genuine link between the State and the ship." LOSC Article 91(1) & "Ships shall sail under the flag of one State only and save, in exceptional cases expressly provided for in international treaties or in this Convention, shall be subject to its exclusive jurisdiction on the high seas." LOSC Article 92(1), Churchill n18 p178. Brittin n945 p115

<sup>1080</sup> *ibid* p114. Report of Lord Donaldson's Inquiry into the Prevention of Pollution from Merchant Shipping *Safer Ships, Cleaner Seas* (1994) p61, 63

<sup>1081</sup> Burke n588 p141

Convention the tonnage on the open register has increased dramatically and little or no development of merchants fleets of developing States has occurred.<sup>1082</sup>

### **Nuclear-Powered Vessels, Nuclear Material and Nuclear Testing at Sea**

While it is within a States jurisdiction to preclude nuclear-powered vessels or nuclear cargo material from entering internal waters, the position in regard to the other zones is more complicated. On the 6 August 1986, the States of the South Pacific opened for signature the South Pacific Nuclear Free Zone Treaty. While these States have particular concerns about the use or carriage of nuclear material the Treaty is not contrary to accepted international law practice on freedom of navigation, nor does it compromise security arrangements and agreements in the area. Because three major nuclear powers have territory in the proposed zone, the first of three protocols was prepared for discussion with these powers in regard to nuclear testing in the area. The United Kingdom, the United States and the USSR had already ceased this type of testing in accordance with the partial Test Ban Treaty.<sup>1083</sup> Nuclear testing results in large areas being made either unsafe for navigation and overflight or are cordoned-off.

France has not become party to the Treaty and this is evidenced by the tests conducted during 1995,<sup>1084</sup> and the fact that France is engaged in the transportation of nuclear waste as a commercial enterprise.<sup>1085</sup> *MV Pacific Teale* transported nuclear waste from France to Japan arrived in Japan on 19 March 1997.<sup>1086</sup>

The second protocol of the Treaty calls for an undertaking not to use nuclear weapons against the States in the zone. This had, in effect been agreed to by the nuclear-weapon States in the form of 'negative security guarantees'. The third protocol required nuclear powers to prohibit manufacture, stationing, testing, and verification in the zone.<sup>1087</sup> New Zealand has enacted legislation in accordance with the Treaty which does not interfere with innocent passage in territorial waters or in or over straits.<sup>1088</sup> Dumping of nuclear waste in the oceans around New Zealand is prohibited and nuclear-powered vessels are prohibited entry to internal waters.<sup>1089</sup> In addition, the Prime Minister of New Zealand requires assurance that warships do not carry nuclear weapons aboard, before permission to enter internal waters would be allowed.<sup>1090</sup>

### **Overflight**

LOSC Article 58 provides for freedom of overflight in the exclusive economic zone. The contiguous zone is part of the exclusive economic zone for overflight and navigational purposes. It is unlikely however that air-maneuvres or weapons exercises would be tolerated by some coastal States in either the exclusive economic zone or the contiguous zone. LOSC contains a provision that, where it does not attribute rights or jurisdiction in the exclusive economic zone or the contiguous to a State, and a conflict situation arises between the interests of a coastal State and any other State, the conflict must be resolved on the basis of equity. The relevant circumstances, and the respective interests of the parties concerned, as well as the international community must be taken into account.<sup>1091</sup>

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<sup>1082</sup> *ibid* p142

<sup>1083</sup> C Keating *The Nuclear Free Zone in the South Pacific* p150

<sup>1084</sup> *Cape Times* (19 March 1997) p9

<sup>1085</sup> *ibid*

<sup>1086</sup> *ibid*

<sup>1087</sup> Keating n1069 p150

<sup>1088</sup> *ibid* p152-154

<sup>1089</sup> *ibid* p154

<sup>1090</sup> *ibid* p155

<sup>1091</sup> LOSC Article 59

## COMMENTED GLOSSARY OF TERMS RELATED TO NAVIGATION USED IN LOSC

(Unless otherwise stated all definitions are taken from AJ Kerr, NR Guy et al IHO Manual on Technical Aspects of United Nations Convention on Law of the Sea 1982 3rd Ed 1993.)

### AID TO NAVIGATION (Navigational Facility, Safety Aids.)

*A device, external to a vessel, charted or otherwise published, serving the interests of safe navigation.*

#### Comment

The SOLAS Convention draws a distinction between an 'aid to navigation' and a 'navigational aid'. An aid to navigation is an aid which is external to the vessel, such as lighthouses, navigational-positioning satellites, and radio-direction-finding stations. Navigational aids are those aids aboard the vessel such as charts, whether paper or digital charts, compasses, and radar.<sup>1092</sup>

### ARCHIPELAGIC SEA LANE

*An archipelagic State may designate sea-lanes and air routes there above, suitable for the continuous and expeditious passage of foreign ships and aircraft through or over its archipelagic waters and adjacent territorial sea.*<sup>1093</sup>

#### Comment

Prior to the drawing of archipelagic baselines many traditional sea routes passed within the archipelagos concerned. It would have been impossible to reach consensus on this type of baseline if concessions had not been made to these routes. The archipelagic waters enclosed by these baselines, in many instances cover large areas of water.<sup>1094</sup> While the right of innocent passage is retained in archipelagic waters the archipelagic State may designate sea lanes, air routes and traffic separation schemes<sup>1095</sup> through and over these waters. All ships including warships may use these sea lanes for archipelagic sea lane passage provided they respect the schemes and abide by the regulations governing them.<sup>1096</sup> Archipelagic passage is defined as follows:

*...means the exercise in accordance with this Convention of the rights of navigation and overflight in the normal mode solely for the purpose of continuous, expeditious and unobstructed transit between one part of the high seas or an exclusive zone and another part of the high seas or an exclusive economic zone.*<sup>1097</sup>

These sea-lanes must traverse the archipelagic waters and the adjoining territorial seas following where possible the normal routes previously used by vessels and aircraft.<sup>1098</sup> The archipelagic State is required to show the sea-lanes and the traffic schemes on charts of a suitable scale. These lanes and schemes should be indicated by a central co-ordinated axis in the middle of the lane or route and vessels are to remain within 25 nm on either side of this axis.<sup>1099</sup> Regardless of the 25 nm allowed, a vessel and aircraft may not navigate closer to the coasts than 10% of the distance

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<sup>1092</sup> IHO n192 p7

<sup>1093</sup> LOSC Article 53(1)

<sup>1094</sup> Scovazzi n46

<sup>1095</sup> LOSC Article 53(1)(6)

<sup>1096</sup> LOSC Article 53 (11)

<sup>1097</sup> LOSC Article 53 (3)

<sup>1098</sup> LOSC Article 53(4)

<sup>1099</sup> LOSC Article 53(5)

between the nearest points on the coast on either side of the sealane at that position.<sup>1100</sup> Traffic separation schemes must be submitted to the competent international organisation, in this case the International Maritime Organisation, for adoption. This must similarly be done if changes to these schemes are required by the archipelagic State and sufficient notice must be given and the changes published.<sup>1101</sup> If no schemes are designated, the established, normally used, international routes must be used by ships and aircraft.<sup>1102</sup>

### CHART (Nautical/ Navigational Charts)

*A Nautical Chart specially designed to meet the needs of marine navigation. It depicts such information as depths of water, nature of seabed, configuration and nature of the coast, dangers and aids to navigation, in a standardised format; also called simply, Chart.*

#### Comment

The role of the nautical chart has been extensively discussed in Parts II and III. It is likely that the paper nautical chart will shortly be supplemented, and then replaced by electronic charts. The SOLAS Convention requires all vessels to carry nautical charts as navigational aids.<sup>1103</sup> The introduction of digital charts will revolutionise navigation and vessel traffic-control systems and while great benefit to both these navigational areas will be obtained it is possible that, in the early stages, with the lack of the human element in the day-to-day navigation, other threats, such as collisions and pollution could be a major factor. Great care should be used in the use of nautical charts, as they are only a depiction of data in a format that is most suitable for the navigator of a vessel. The data may be suitable for delimitation purposes, provided it is not used graphically in nautical chart format.

### DANGER TO NAVIGATION

*A hydrographic feature or environmental condition that might hinder, obstruct, endanger or otherwise prevent safe navigation.*

#### Comment

A coastal State is obligated to provide aids to navigation for the use of all mariners. It is also required to advise the international maritime community of any dangers in its waters that are known to the State.<sup>1104</sup> LOSC does not make provision for the costs of these services to be recovered from the vessels passing the coast, but it has been possible, through port dues levied on vessels calling at the ports of the coastal State, to offset some of the expenses incurred.<sup>1105</sup>

### ENCLOSED SEA

*For the purpose of this Convention, 'enclosed or semi-enclosed sea' means a gulf, basin, or sea surrounded by two or more States and connected to another sea or the ocean by a narrow outlet or consisting entirely or primarily of the territorial seas and exclusive economic zones of two or more coastal States.*<sup>1106</sup>

#### Comment

This is a feature which is not found in southern Africa. The best known enclosed sea is the Caspian Sea. It is debatable why it is known as a sea when larger enclosed waters, such as Lake Victoria are

<sup>1100</sup> ibid

<sup>1101</sup> LOSC Article 53 (9)(7)

<sup>1102</sup> LOSC Article 53 (12)

<sup>1103</sup> SOLAS n965

<sup>1104</sup> Territorial Sea's Convention n26 Article 15(2), LOSC Article 24(2), Churchill n18 p78

<sup>1105</sup> LOSC Article 26

<sup>1106</sup> LOSC Articles. 122, 123

not.<sup>1107</sup> LOSC has listed the conduct of States bordering these seas in sufficient detail to ensure that the interests of all States concerned are assured.

### **HARBOUR WORKS (Port Facility)**

*Permanent man-made structures built along the coast which form an integral part of the harbour system such as jetties, moles, quays or other port facilities, coastal terminals, wharves, breakwaters, sea walls, etc. Offshore installations that are not an integral part of the system are not able to be considered as baselines from which to generate the territorial sea.*

#### **Comment**

The low-water line of these structures may be used as baselines from which to generate the outer limit of the territorial sea and other zones.<sup>1108</sup>

### **INSTALLATION (OFF-SHORE)**

*Man-made structure in the territorial sea, exclusive economic zone, or on the continental shelf usually for the exploration or exploitation of marine resources. They may also be built for other purposes such as marine scientific research, tide observations, etc.*<sup>1109</sup>

#### **Comment**

Artificial installations are not considered as islands by LOSC and may not be used to generate any maritime zones.<sup>1110</sup> Low-tide elevations, on which lighthouses or similar installations are built may be used to connect straight baselines of the coastal State. In the interest of safe navigation, due notice must be given of the construction, or removal, of the installations.<sup>1111</sup> In addition, permanent warning signals must be given of the presence of the installation and a safety zone of 500 metres from the outermost points of the installation may be declared.<sup>1112</sup>

### **NAVIGATIONAL AID**

*A shipboard instrument or device used to assist in the navigation of a vessel.*

#### **Comment**

All navigational instrumentation aboard a vessel is regarded by SOLAS as a navigational aid.

### **ROADSTEAD**

*An area near the shore where vessels are intended to anchor in a position of safety; often situated in a shallow indentation of the coast.*

#### **Comment**

Roadsteads are usually an integral part of a port and within or close to the port limits. It may also be partly within or without territorial waters, but may be regarded as territorial waters.<sup>1113</sup> The limits of a roadstead may be co-ordinated or shown on charts, but should it fall partly outside of the territorial waters the co-ordinates must be given or shown.

<sup>1107</sup> The New International Atlas(Collins) (1980) p72 & 154

<sup>1108</sup> LOSC Articles 5, 11

<sup>1109</sup> LOSC Article 11

<sup>1110</sup> LOSC Article 60(8)

<sup>1111</sup> LOSC Articles 7(4), 60(3)

<sup>1112</sup> LOSC Article 60(5)

<sup>1113</sup> LOSC Article 12

## SAFETY ZONE

*Zones established by the coastal State around artificial islands, installations and structures in which appropriate measures to ensure the safety both of navigation and of the artificial islands, installations and structures are taken. Such zones shall not exceed a distance of 500 metres around them, except as authorised by generally accepted international standards or as recommended by the competent international organisation.*

### Comment

A safety zone of 500 metres from the extremities of an installation may be proclaimed. In some confined areas, where it is necessary to maintain sophisticated watch systems on the installation, this may be practical. On the African south coast, where only one platform is found for thousands of nautical miles, it is possible that the personnel on both the vessel and the rig may not be as vigilant as necessary. Attempts have been made to justify an extension of this distance.<sup>1114</sup>

## STRAIT

*Geographically, a narrow passage between two landmasses or islands or groups of islands connecting two larger sea areas.*

### Comment

Only straits that are 'used for international navigation' are considered as straits for the purpose of LOSC. There is no definition in LOSC of a strait used for international navigation. It appears that the Corfu Channel Case is used for the criteria.<sup>1115</sup> There are no such straits in South African waters.

## THALWEG

*The line of maximum depth along a river channel. It may also refer to the line of maximum depth along a river valley or in a lake.*

### Comment

The thalweg is usually accepted as the boundary between two States bordering on an international river. This is practical, in that for the river to be used by international shipping and the shipping of both States, the vessels must have access to the deepest channel wherever that is in the river. The US Supreme Court described the situation as follows: If the dividing line was to be placed in the centre of the stream rather than in the centre of the channel, the whole track of navigation might be thrown within the territory of the one State to the exclusion of the other.<sup>1116</sup>

## TRAFFIC-SEPARATION SCHEME

*A routing measure aimed at the separation of opposing streams of traffic by appropriate means and by the establishment of traffic lanes.*

### Routing Systems

*Any system of one or more routes and/or routing measures aimed at reducing the risk of casualties; it includes traffic-separation schemes, two-way routes, recommended tracks, areas to be avoided, inshore traffic zones, roundabouts, precautionary areas and deep-water routes.*

<sup>1114</sup> T de Jager (unpublished letter to Principal Officer, Marine Division, Department, Customs House Foreshore, Cape Town. (23 August 1994))

<sup>1115</sup> DB Hamman "Passage Rights Through Straits" Institute of Marine Law Pub No 5 (1987)

<sup>1116</sup> Brittin n945 p81

## **Comment**

The coastal State has the right to introduce routing systems in the interests of the coastal State and safe navigation,<sup>1117</sup> but it has obligations to ensure that the routes are safe for navigation, that the characteristics of vessels normally traversing the area are catered for, that traffic density is considered and that the recommendations of competent international organisations are taken into account.<sup>1118</sup>

## **UNITED STATES OF AMERICA'S PROTESTS TO THE NAVIGATION ACTIONS OF STATES**<sup>1119</sup>

### **Albania**

Foreign warships may only enter territorial waters with special authorisation.<sup>1120</sup>

### **Algeria**

- a) Foreign warships must obtain special permission to enter territorial waters.<sup>1121</sup>
- b) Military related vessels must request authorisation to enter territorial waters at least 15 days in advance.<sup>1122</sup>

### **Antigua and Barbuda**

Foreign warships need permission to enter territorial waters.<sup>1123</sup>

### **Argentina**

Freedom of navigation and overflight guaranteed only beyond 12 nm.<sup>1124</sup>

### **Bangladesh**

Foreign warships must obtain permission to enter territorial waters.<sup>1125</sup>

### **Barbados**

Foreign warships must obtain permission to enter territorial waters.<sup>1126</sup>

### **Brazil**

Permission required for more than 3 warships to enter territorial waters at one time and legislation for security regulations affecting warships and other public vessels.<sup>1127</sup>

### **Bulgaria**

Warships are required to obtain permission to enter territorial waters to which the US objects and to use sealanes to which the US does not object.<sup>1128</sup>

### **Burma**

Foreign warships require permission to enter territorial waters.<sup>1129</sup>

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<sup>1117</sup> LOSC Articles 22(1)(2) &(4)

<sup>1118</sup> LOSC Article 22(3)

<sup>1119</sup> Limits n815

<sup>1120</sup> *ibid* p2

<sup>1121</sup> *ibid* p2, Decree No 63-403- US protested in 1964 and 1982

<sup>1122</sup> *ibid* p3, Decree No 72-194- US protested 1982

<sup>1123</sup> *ibid* p5, Territorial Waters Act n799

<sup>1124</sup> *ibid* p6, Law No 17,094 29 December 1966- US protested 1967

<sup>1125</sup> *ibid* p11, Territorial Waters Act No 26 and Proclamation No LT-1/3/74 1974- US protested 1982

<sup>1126</sup> *ibid* p12, Territorial Waters Act No 26 1977- US protested 1982

<sup>1127</sup> *ibid* p17, Decree No 35,844 1954 Decree Law No 1098 1970, Law No 8617- US protested 1970

<sup>1128</sup> *ibid* p19, Decree No 514 as amended by Decree No 90 of 1951- US protested 1952, 1984, 1985, 1986



## **China**

- a) Foreign warships require permission to enter territorial waters.<sup>1130</sup>
- b) Claims to security jurisdiction in the contiguous zone.<sup>1131</sup>

## **Congo**

Foreign warships require permission to enter territorial waters.<sup>1132</sup>

## **Costa Rica**

Fishing vessels must report entry and exit of exclusive economic zone.<sup>1133</sup>

## **Denmark**

- a) Warships are required to notify intention to enter territorial waters but not straits.<sup>1134</sup>
- b) Not more than 3 warships may enter territorial waters at any one time without permission except in straits.<sup>1135</sup>

## **Djibouti**

Nuclear powered vessels or vessels carrying nuclear material or waste must give prior notification of intention to enter territorial waters.<sup>1136</sup>

## **Egypt**

Foreign warships, nuclear powered vessels or vessels carrying nuclear materials or noxious substances require permission to enter territorial waters.<sup>1137</sup>

## **Finland**

Foreign warships require permission to enter territorial waters, although these waters are only 4 nm wide.<sup>1138</sup>

## **Grenada**

Foreign warships require permission to enter territorial waters.<sup>1139</sup>

## **Guyana**

Foreign warships must give notice to enter territorial waters.<sup>1140</sup>

## **India**

Foreign warships must provide notice of intent to enter territorial waters.<sup>1141</sup>

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<sup>1129</sup> ibid p20. Limits n1098 p20, Territorial Sea and Maritime Zones Law No 3 1977- US protested 1982

<sup>1130</sup> ibid p27. Maritime Traffic Safety Law 1983, Law on the Territorial Sea and the Contiguous Zone 1992- US protested 1992

<sup>1131</sup> ibid p27, Law on the Territorial Sea and the Contiguous Zone 1992- US protested 1992

<sup>1132</sup> ibid p30, Ordinance No 049/77 1977- US protested 1987

<sup>1133</sup> ibid p32, Law No 62676 1978- US protested 1979, 1992

<sup>1134</sup> ibid p37-38, Royal Ordinance No 437 Ordinance Governing Admission of Foreign Warships and Military Aircraft to Danish Territory in Time of Peace. 1966, 1976- US protested 1991

<sup>1135</sup> ibid

<sup>1136</sup> ibid p40, Law 52/AN/78 1979- US protested 1989

<sup>1137</sup> ibid p44, Declaration with Law of the Sea Convention ratification 1983, Decree No 27 1990- US protested 1985, 1991 and 1991

<sup>1138</sup> ibid p51, Law No 463/59 1956, Decree Amendment 656/80 1981- US protested 1989

<sup>1139</sup> ibid p62, Territorial Waters Act No 17 1978- US protested 1986

<sup>1140</sup> ibid p66, Maritime Boundaries Act No 10 1977- US protested 1982

<sup>1141</sup> ibid p70, Maritime Zones Act No 80 1976- US protested 1983

## **Iran**

- a) Prior permission needed for foreign warships to enter territorial waters.<sup>1142</sup>
- b) Reserves right to withhold permission from foreign warships to pass through territorial waters when exercising right of innocent passage and reserves the use of straits for international navigation by those Flag States that have signed LOSC.<sup>1143</sup>

## **Republic of Korea (South)**

Foreign warships and non-commercial vessels must give notice of intent to enter territorial waters. This does not apply to straits used for international navigation with no high seas.<sup>1144</sup>

## **Libya**

Commercial vessels are required to give notice of intent prior to entering territorial waters and are restricted to daylight hours for passage.<sup>1145</sup>

## **Maldives**

Foreign warships require permission to enter territorial waters.<sup>1146</sup>

## **Malta**

Foreign warships and nuclear powered vessels require prior permission to enter territorial waters.<sup>1147</sup>

## **Mauritius**

Notification required from foreign warships to enter territorial waters.<sup>1148</sup>

## **Nicaragua**

Merchant vessels allowed innocent passage subject to national law and international agreements. This was followed by requirement for clearance for overflight and vessel transit of territorial waters.<sup>1149</sup>

## **Oman**

Requirement for foreign nuclear powered warships to obtain permission to enter territorial waters.<sup>1150</sup>

## **Pakistan**

Foreign warships require permission to enter territorial waters, foreign supertankers, nuclear powered vessels and ships carrying nuclear material must give prior notice to enter these waters.<sup>1151</sup>

## **Poland**

Foreign warships require prior permission to enter territorial waters.<sup>1152</sup>

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<sup>1142</sup> ibid p73, Act 1959, Maritime Areas Act 1993- US protested 1994

<sup>1143</sup> ibid p73, Declaration on signing LOSC 10 December 1982- US protested 1987, 1994

<sup>1144</sup> ibid p84, Territorial Seas Law No 3037 1977, Presidential Decree No 9162 1978- US protested 1979

<sup>1145</sup> ibid p89, Territorial Waters Act No 2 1959, Shipping Regulations 1985- US protested 1985

<sup>1146</sup> ibid p93, Constitution Article 1 1975, Law No 432/76 1976- US protested 1982

<sup>1147</sup> ibid p94, Act No XXIV 1978, 1981- US protested 1981

<sup>1148</sup> ibid p 97, Territorial Seas Act 1970, Maritime Zones Act No 13 and Proclamation No 7 1977- US protested 1982

<sup>1149</sup> ibid p 107, Act No 205 1979, Circular CD-5-18-81 1981- US protested 1982 and 1985

<sup>1150</sup> ibid p 111, Declaration on signing LOSC 1 July 1983- US protested 1991

<sup>1151</sup> ibid p112, Territorial Waters and Maritime Zones Act 1976-Us Protested 1982

<sup>1152</sup> ibid p118, Order of Minister of Defence 1957- US protested 1989

## **Romania**

Foreign warships require prior permission to enter territorial waters.<sup>1153</sup>

## **Seychelles**

Foreign warships must give prior notice of intention to enter territorial waters.<sup>1154</sup>

## **Spain**

Authority over aircraft exercising right of transit over straits and of pollution control over vessels using straits for international navigation.<sup>1155</sup>

## **Sri Lanka**

Foreign warships require prior permission to enter territorial waters.<sup>1156</sup>

## **Sudan**

Foreign warships require prior permission to enter territorial waters.<sup>1157</sup>

## **Sweden**

Except in Ore Sound foreign warships must give prior warning of intention to enter territorial waters.<sup>1158</sup>

## **Syria**

Foreign warships need prior permission to enter 35 nm wide territorial waters.<sup>1159</sup>

## **Vietnam**

Foreign warships require permission to enter territorial waters. 30 days notice is needed. Not more than 3 warships may be in territorial waters at any one time.<sup>1160</sup>

## **Yemen**

- a) Prior notification required for foreign warships to enter territorial waters.<sup>1161</sup>
- b) This was changed to a requirement for foreign warships to obtain permission to enter territorial waters. Nuclear powered vessels or vessels carrying radioactive material must give prior notification of intention to enter territorial waters.<sup>1162</sup>

## **Summary of Claims and Protests**

As of December 1995 128 States have claims to territorial waters with breadths of 12 nm or less. Of the 128 117 have claimed 12 nm wide territorial seas. Only 17 have claims to territorial seas with breadths from 20 to 200 nm.

55 States have contiguous zones of 24nm or less and one with a breadth of 41nm.

19 have claims to 200nm breadth fisheries zones and 94 to exclusive economic zones in accordance with LOSC.<sup>1163</sup>

<sup>1153</sup> ibid p 121, Decree No 39 1956- US protested 1989

<sup>1154</sup> ibid p 130, Maritime Zones Act No 15 of 1977- US protested 1982

<sup>1155</sup> ibid p 137, Declaration when signing LOSC on 12 April 1984- US protested 1985

<sup>1156</sup> ibid p 138, Maritime Zones Law n928

<sup>1157</sup> ibid p 139, Territorial Waters and Continental Shelf Act No 106 1970-US protested 1989

<sup>1158</sup> ibid p 141, Law No 374/Royal Notice No 366 1966- US protested 1984

<sup>1159</sup> ibid p 142, Law No 37 1981- US protested 1981 and 1989

<sup>1160</sup> ibid p 162, Statement Decree No/C 1977 and 1980- US protested 1982

<sup>1161</sup> ibid p 164, Presidential Resolution No 17 (Sanaa) 1967- US protested 1986

<sup>1162</sup> ibid p 164, Law No 8 (Aden) 1970- US protested 1982

An analysis of the protests highlights the widespread practice of coastal States requiring foreign warships to give prior notification to enter territorial waters, (11 protests) and to obtain prior permission (27 protests). There are therefore 38 States not allowing uninhibited right of innocent passage in their territorial seas.

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<sup>1163</sup> ibid p166

## CHAPTER X

## RESOURCES

## INTRODUCTION

Natural resources that exist in or under the sea are of great interest to all States, whether they are coastal States or not. Non-coastal States were initially concerned that they would not have access to the exploitation of these resources, but it was soon realised that other factors had to be considered. These included research, exploration, protection and an equitable sharing of the resources. The idea that a State could unilaterally claim individual rights to the sea and its wealth was contested at the UN General Assembly in 1967 by Ambassador Arvid Pardo of Malta, when he called for the sharing of this wealth as the Common Heritage of Mankind.<sup>1164</sup> This philosophy was given substance in LOSC<sup>1165</sup> and emphasis was placed on the rights, privileges and responsibilities of States, whether coastal, landlocked or geographically disadvantaged. Two types of resources were categorised, renewable and non-renewable and one of the primary resources of the seas is fish, whether mobile and sedentary.

## UTILIZATION

Linked with the resources are their uses and they may be categorised as follows:

- a) *extractive uses- activities involving removal of resources from the environment;*
- b) *intrusive uses- those that disrupt the seabed or may degrade the environment and*
- c) *benign uses- activities that take up space but do not impact the seabed or environment.*<sup>1166</sup>

In the 'extractive' category are oil and gas, living resources, minerals and energy systems. In the 'intrusive' category are pipelines, vessels and their potential spills, waste disposal, acoustic activity and dumping and in the 'benign' category are instruments with their related deployment, security systems, navigation research, monitoring and sanctuaries and recreational activities.<sup>1167</sup> The resources in these three categories will be considered in this Chapter and the possible effect of their harvesting on the environment will be considered in Chapter XII.

## RENEWABLE RESOURCES (FISH)

## Mobile Resources

Fishing has been a major source of food and trade since the earliest times. Even some of the methods that are employed today were in use, in a primitive form, centuries ago. The drift-net technique, used

<sup>1164</sup> LOSC pxxxvii

<sup>1165</sup> LOSC pxx

<sup>1166</sup> Report of the Committee on Seabed Utilisation in the Exclusive Economic Zone Our Seabed Frontier - Challenges and Choices(1989) p3

<sup>1167</sup> *ibid*

commercially today, albeit on a much smaller scale, was in use in 495 AD.<sup>1168</sup> As mentioned in Chapter I, herring fishing contributed massively to the wealth of Holland, and the power of the Hanseatic League is said to be based on the Baltic herring fisheries. The demise of the League is attributed to the fact that the fish migrated away from the area under their control.<sup>1169</sup>

The traditional resource of mobile fish and sedentary species is reasonably well documented and must be well managed. The exploitation and preservation of most species should be carefully monitored and international interest and actions must ensure that over-exploitation does not occur. It is hoped that the management of this resource will improve and that harvesting will match the recovery levels necessary to ensure the continuation of the species.

A comparison of the value of the various resources of the sea that are being harvested indicates that fishing is an industry that is worth four times that of all oil production and about twenty times the value of all the other resources combined.<sup>1170</sup> Like all renewable resources, a major factor is management and protection. This is to ensure that the resource is neither depleted to the point where it is beyond recovery nor enhanced beyond its natural levels so as to upset the natural food chain. LOSC introduced a new approach to these sources and especially to fish.

The 1958 Convention on Fishing and Conservation of the Living Resources of the High Seas, dealt with the following subjects in regard to living resources;

- a) rights and responsibilities of States;
- b) conservation of the living resources vis a vis sustainable yield;
- c) co-operation between States in regard to conservation;
- d) dispute settlement in these matters and the formation of a UN Commission in accordance with Article 33 of the UN Charter;
- e) the right to engage in conservation research and the research programmes of other States in the high seas;
- f) regulations for the control of semi-permanent fishing devices attached to the sea-bed.

As can be seen from earlier chapters, the activities of England, the Netherlands, the Scandinavian countries and others bordering the North Sea, the importance of fishing, and the rights attached thereto, have, on occasions, led to war. Freedom to fish on the high seas has been considered a right in customary law, almost or as long as fishing has existed.<sup>1171</sup>

The 1958 Convention was the first time the control of exploitation and preservation of fishing became international law.<sup>1172</sup> The traditional rights of coastal States were confined to territorial and internal waters. The rights of the coastal State in these areas was unquestioned. It had the right to regulate any fishing activity there and to enforce its national legislation.<sup>1173</sup>

Beyond the limits of these waters, no interference in the fishing activities of other States was allowable in law. One of the problems of those negotiating the 1958 Conventions was the inability to

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<sup>1168</sup> King n306 p292

<sup>1169</sup> *ibid* p293

<sup>1170</sup> SJ Holt "The Food Resources of the Ocean", *Ocean Science* (September 1969)

<sup>1171</sup> Fulton n60 p8

<sup>1172</sup> Brittin n945 p126, Convention on Fishing and Conservation of the Living Resources of the High Seas, Geneva (29 April 1958)

<sup>1173</sup> S Oda "Fisheries Under the United Nations Convention on Law of the Sea" *AJIL* Vol 77 (October 1983) p739

achieve consensus on extending the limits of the territorial waters. This would have had the direct effect of reducing the size of the areas where freedom of fishing had existed for so long. By the start of UNCLOS III, only 27 States had ratified the 1958 Convention on Fishing and Conservation of the Living Resources of the High Seas.<sup>1174</sup>

One of the Articles of one of this 1958 Geneva Convention<sup>1175</sup> was intended to protect mobile resources of the high seas.

*All states have the duty to adopt, or to co-operate with other states in adopting, such measures for their respective nationals as may be necessary for the conservation of the living resources of the high seas.*<sup>1176</sup>

The 21 Articles of LOSC dealing with the exclusive economic zone establish this zone as “*sui generis*”(unique). The rights and privileges, of both coastal and other States, have been considered in Chapters III, VIII and IX, but while freedom of navigation and overflight have been retained in this zone, fishing rights have not. Freedom to fish still applies on the high seas, but Articles 116 to 120 require all States Parties to LOSC to conserve the living resources, to co-operate with other States in this process and to exchange research and scientific information necessary to achieve this.

Control of research and the management of fish resources, which had been under limited international control up to the time of UNCLOS III, has now largely been shifted to the coastal State.<sup>1177</sup> The transfer of these responsibilities to a coastal State gives that State greater opportunities to exploit these resources. In southern African this could place an unacceptable load on coastal States that neither have the capacity to harvest these resources nor the potential to manage them. This could, and has, led to illegal exploitation and over-exploitation of areas that were previously governed by international agreements.<sup>1178</sup>

The international organisations that have been concerned with fisheries management were either established under the aegis of the UN Food and Agriculture Organisation (FAO) and funded by the UN or exist as a result of regional or bilateral conventions or agreements.

There are numerous bodies within FAO.

- a) Regional Fisheries Advisory Commission for the Southwest Atlantic (CARPAS);
- b) Fisheries Committee for the Eastern Central Atlantic (CECAF);
- c) General Fisheries Council for the Mediterranean (GFCM);
- d) Indian Ocean Fisheries Commission. (IOFC);
- e) Western Central Atlantic Fisheries Commission (WECAFC).

Regulatory bodies responsible for specific species preservation include:

- a) Inter-American Tropical Tuna Commission. (IATTC);

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<sup>1174</sup> Brittin n945 p127

<sup>1175</sup> 1958 Convention on Fishing and Conservation of the Living Resources of the High Seas n1158 Preamble.  
See also Oda n1159 p739

<sup>1176</sup> ibid Article 1(2)

<sup>1177</sup> GN Barrie “Fisheries and the 1982 United Nations Law of the Sea Convention” *Acta Juridica* (1986)

<sup>1178</sup> Namibian Cases n778

- b) International Commission for the Conservation of Atlantic Tunas. (ICCAT);
- c) International Halibut Commission. (IPHC);
- d) International Pacific Salmon Fisheries Commission. (IPSFC);
- e) International Whaling Commission (IWC);
- f) North Pacific Fur Seal Commission (NPFSC).

Regional bodies include;

- a) Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR);
- b) International Baltic Sea Fisheries Commission (IBSFC);
- c) International Commission for the Southeast Atlantic Fisheries (ICSEAF);
- d) International North Pacific Fisheries Commission (INPFC);
- e) Mixed Commission for Black Sea Fisheries (MCBSF);
- f) Northwest Atlantic Fisheries Organisation (NAFO previously ICNAF);
- g) International Commission for the Northwest Atlantic Fisheries (ICNAF);
- h) North -East Atlantic Fisheries Commission (NEAFC);
- i) Northwest Pacific Fisheries Commission. (NPFC);
- j) Permanent Commission for the Conference on the Use and Conservation of the Marine (PCCUCM);
- k) Small Resources of the South Pacific (SPPC).

The RSA is party to many international conventions or agreements and the following are included:

- a) Zone of Peace and Co-operation of the South Atlantic (ZOPCSA);
- b) Membership of the International Maritime Organisation (IMO);
- c) Intergovernmental Oceanographic Commission (IOC);
- d) 1995 Protocol on Environmental Protection to the Antarctic Treaty (Madrid Protocol) has been ratified;
- e) Involvement in the 1993 UN Food and Agricultural Organisation FAO Agreement to Promote Compliance with International Conservation and Management Measures by Fishing Vessels on the High Seas is being considered;
- f) Involved with FAO in finalising a Code of Conduct for Responsible Fisheries;
- g) Has been involved for two years in negotiations on a Draft Global Programme of Action to Protect the Marine Environment from Land Based Activities in accordance with LOSC Part XII.



In addition the RSA implements provisions from the following;

- a) International Commission for the Conservation of Atlantic Tunas (ICCAT);
- b) Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR);
- c) Indian Ocean Tuna Commission (IOTC) is under consideration;.
- d) International Whaling Commission (IWC);
- e) Declaration of the Marine Environment;
- f) Resolution leading to the establishment in 1994 of the Indian Ocean Whaling Sanctuary was co-sponsored;
- g) Indian Ocean Marine Affairs Co-operation Organisation (IOMAC) is supported;
- h) UNEP Regional Seas Programmes is supported.<sup>1179</sup>

## CATEGORIES OF LIVING RESOURCES

### Highly Migratory Species

These fish are listed in Annex 1 of LOSC and include 8 varieties of Tuna, certain Mackerel, Pomfrets, Marlins, Sail-fishes, Swordfish, Sauries, Dolphin, Oceanic Sharks and Cetaceans. As can be seen from the list of commissions and agreements to which the RSA is a party, much activity in this region is directed to the preservation of these species. Some of these fish range over large distances across the oceans. An example is the tuna which is known to range from Chile to the southern Californian coast.<sup>1180</sup> It is probably only possible to control the catching and preservation of these fish through international organisations.

LOSC requires States Parties to co-operate, directly or through the relevant international organisations, in implementing conservation and optimum utilisation of the highly migratory species as listed in Annex 1 of LOSC.<sup>1181</sup>

The Agreement arising from the UN Conference on Straddling Fish Stocks and Highly Migratory Species.

*will for the first time bind States to conserve and sustainedly manage high-sea fisheries and to settle fishing disputes peacefully.*<sup>1182</sup>

### Anadromous Fish

These are fish that spawn in the upper reaches of freshwater rivers and streams. When they reach a certain maturity they migrate to the sea and spend the next two to three years in the oceans. They only return to the rivers to spawn or die. It is obvious that the State in whose rivers the fish spawn has the greatest opportunity of exercising control over them at the critical times in their life cycle. These

<sup>1179</sup> DGM Miller "A Discussion Document on Possible Implications of South African Ratification of the United Nations Convention on the Law of the Sea (LOSC) in Respect of the Marine Environment and Fisheries." (unpublished document, kindly made available to me by the author) p3-4

<sup>1180</sup> Brittin n945 p133

<sup>1181</sup> LOSC Article 64 and Annex 1

<sup>1182</sup> UN Document A/Conf 164/37 opened for signature on 4 December 1995, UN Press Release SEA/1508 (December 1995)

States need not be coastal States and in LOSC provision is made for all States where spawning occurs to exercise control and responsibility.<sup>1183</sup> This is the only species where the fishing is restricted to landward of the outer limit of the exclusive zone.<sup>1184</sup> It is again the responsibility of the coastal State, through whose exclusive economic zone these fish migrate, to regulate catching and preservation.<sup>1185</sup> As this may involve the exclusive economic zones of more than one coastal State, co-operation is expected between these States.<sup>1186</sup> Provision is made for States who have traditionally harvested anadromous fish in the oceans and who would suffer economic dislocation should the ban be enforced on them.<sup>1187</sup> In this instance these States may continue to catch these fish beyond the outer limits of exclusive economic zones but they must co-operate with the coastal States responsible for the preservation of the species.<sup>1188</sup> An example of this is Japan, which has been engaged in deep-water salmon fishing for a long time and would suffer economic dislocation if they were to be forced to cease these operations.<sup>1189</sup> The main fish type in this category is Salmon but this type includes the Atlantic Ocean, red, pink, coho, king, chum, and Pacific species.<sup>1190</sup>

### Catadromous Species

This species is the antithesis of the anadromous species in that they spawn at sea and then spend most of their lives in fresh water. LOSC has similar preservation conditions for this species. The coastal State in whose waters they spend the greater part of their lives is responsible for the management of their harvesting and preservation. It must ensure that the fish can easily ingress and egress when migrating. Other States, through whose exclusive economic zones the fish may migrate, are obliged to co-operate with the coastal State in whose waters the fish spend the majority of their lives.<sup>1191</sup> Harvesting of the species may only be undertaken landwards of the outer limits of the exclusive economic zone, and fishing for catadromous species on the high seas is prohibited. No provision is made for concessions for harvesting of this species outside exclusive economic zones.<sup>1192</sup> The main fish species are eels that spawn at sea, but spend most of their lives in fresh water.<sup>1193</sup>

### Pelagic Fish

Pelagic fish are not specified in LOSC but they are a major fishing resource of many coastal States. Failure to establish either exclusive fishing zones or exclusive economic zones could result in these resources being harvested by any State as a resource of the high seas.<sup>1194</sup> The major fishing areas and grounds in southern Africa are found on the west and southwest coast of the continent.<sup>1195</sup> All large commercial fishing enterprises are labour intensive and require enormous amounts of capital expenditure.<sup>1196</sup> The preservation of these resources is vital to this industry.<sup>1197</sup> While the Cape Anchovy (*Engraulis japonicus*) and the Pilchard (*Sardinops ocellatus*) form the major portion of the pelagic fish caught in these waters, other species are also harvested. They include Maasbanker or Horse Mackerel (*Trachurus trachurus*), Mackerel (*Scomber japonicus*), Redeye Roundherring (*Etrumeus white-head*) and Lantern Fish (*Lampanyctodes myctophidae hectoris*).<sup>1198</sup>

<sup>1183</sup> LOSC Article 66(1)

<sup>1184</sup> LOSC Article 66(2)

<sup>1185</sup> *ibid*

<sup>1186</sup> LOSC Article 66(3)(a)

<sup>1187</sup> *ibid*

<sup>1188</sup> LOSC Article 66(3)(b)

<sup>1189</sup> Brittin n945 p135/6

<sup>1190</sup> Churchill n18 p207, Brittin n1152 p135, JH Tietjen *Dictionary of Marine Sciences* (1988) p244

<sup>1191</sup> Churchill n18 p207

<sup>1192</sup> *ibid*

<sup>1193</sup> *ibid*

<sup>1194</sup> J.D. Cole *Legal Restraints Imposed By South African Legislation on Commercial Exploitation of Pelagic Fish*. *Institute of Marine Law Publication* No 3 (1987) p2 & 16 of Footnote

<sup>1195</sup> *ibid*

<sup>1196</sup> *ibid* p6

<sup>1197</sup> *ibid* p87

<sup>1198</sup> Smith's *Sea Fishes* MM Smith and PC Heemstra (Eds) (1986) p199/201, 199/204, 204/5, 282/305, 638/660, 831/835

Pelagic-fish research is able to estimate the total population of the species at a time. From this a sustainable yield is determined, taking into consideration all the factors impacting on these calculations, such as the accuracy from which the biomass has been extrapolated, trends in the species population and biological factors that could affect the species.<sup>1199</sup>

### **Marine Mammals**

There is nothing in LOSC to prevent the coastal State and international organisations from regulating or prohibiting the exploitation of marine mammals.<sup>1200</sup> In Article 65, States are expected to co-operate in the conservation of mammals and to work with the appropriate international organisations. Included in this category are, Whales, Dolphins, Porpoises, Seals, and Sea Otters.<sup>1201</sup>

### **Sedentary species**

These species are regarded as being relevant to the LOSC continental shelf of a coastal State.<sup>1202</sup> All sedentary species to the outer limit of the LOSC continental shelf are under the management and control of the coastal State.<sup>1203</sup> The coastal State is not obligated to undertake any management or conservation nor is it necessary to accommodate the requests of foreign fisherman to harvest these species in these areas.<sup>1204</sup> Large portions of this area may be under the high seas.

The definition contained in LOSC states:

*...organism, which at the harvest stage, either are immobile on or under the seabed or are unable to move except in constant physical contact with the seabed or the subsoil.<sup>1205</sup> are under the sovereign control of the coastal State.<sup>1206</sup>*

Included in this category are Abalone (Perlemoen), Mussels and Oysters, most of which are harvested in shallower waters.

### **FISHING METHODS.**

LOSC does not contain any specific references to the methods of fishing that may, or may not, be used.<sup>1207</sup> Methods of fishing have remained relatively standard for many years. Trawling, at various depths is still the major method.

This can be divided into two categories:

- a) otter trawl board gear and
- b) purse seine netting.

### **The Otter Trawl<sup>1208</sup>**

This consists of a conical net, which is towed by one or two vessels. The mouth of the net is kept open by otter or trawl boards, which are slung on chain lengths, which ensure that, as it is towed through the

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<sup>1199</sup> Cole n1179 p18

<sup>1200</sup> ibid

<sup>1201</sup> LOSC Article 65

<sup>1202</sup> Orrego n152 p65/67

<sup>1203</sup> LOSC Article 68

<sup>1204</sup> Churchill n18 p208

<sup>1205</sup> LOSC Article 77(4)

<sup>1206</sup> LOSC Article 77(1)

<sup>1207</sup> LOSC Article 62 (4)

<sup>1208</sup> Ross n137 p164, Kunzig n305 p249-250

water, the otter attempts to draw away from the vessel. This method can be used successfully to harvest most species of mobile fish at various depths.

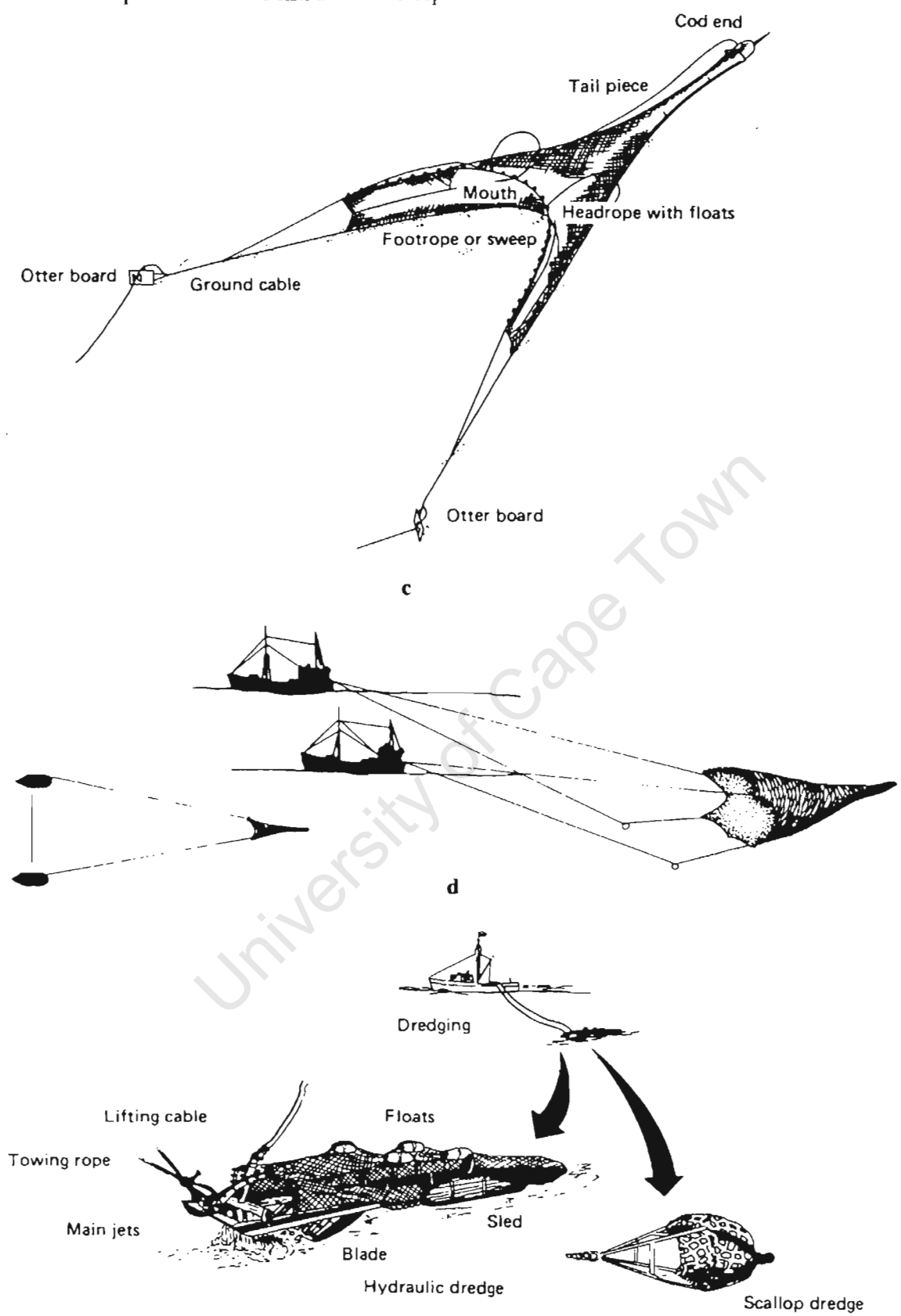


Figure 67 OTTER TRAWL  
(Two vessels using bottom dredges)

## Purse Seine

This method is used by one or two vessels, at a time, for harvesting at relatively shallow depths and the top of the net is buoyed and floats on the surface. The vessel or vessels stream the net in a circle and when the ends of the net meet, the lower portion of the net is drawn together to form a basin shape. The net, with the catch, is then drawn into the vessels. Bottom species are harvested by use of various forms of dredges that are towed over and close to the seabed.

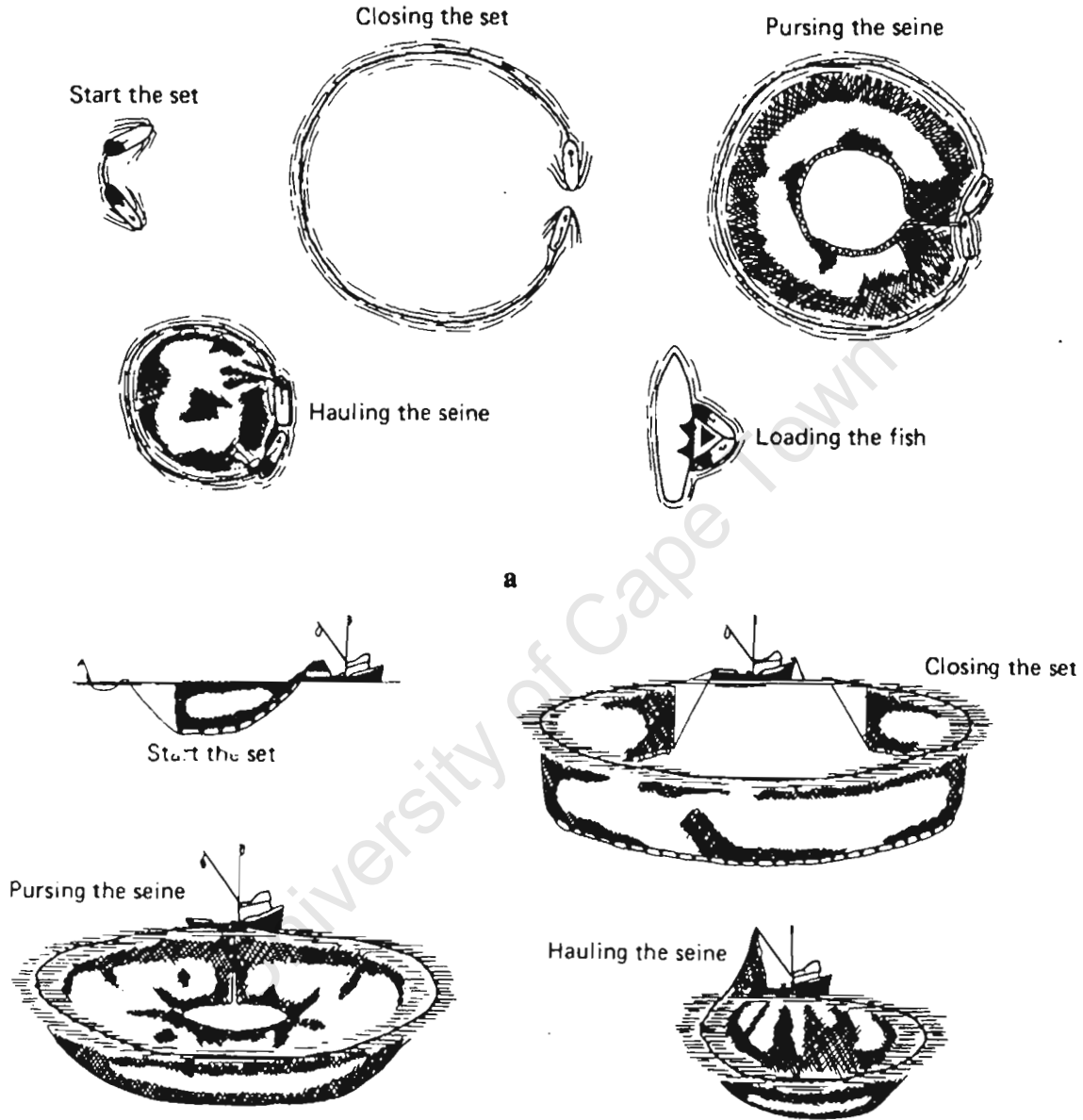


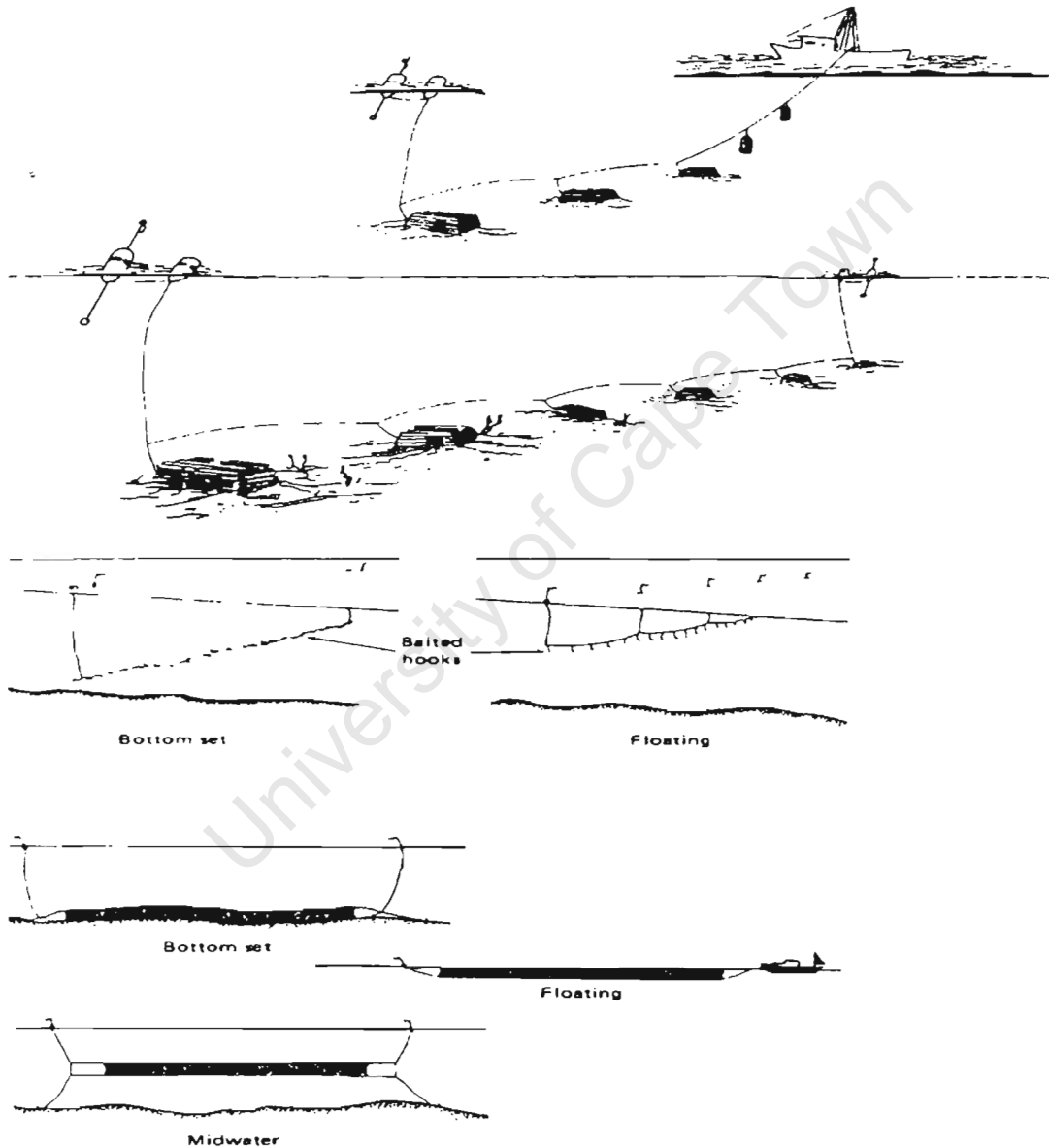
Figure 68 PURSE SEINE FISHING  
(Using one or two vessels)

Some species, such as tuna are caught by long-lines. These are buoyed lines with baited hooks hanging from the line as it is laid at sea in a straight line. These lines can also be used on the seabed. Species such as lobsters are caught by the lowering of 'pots', singly or in groups, onto the seabed. The lobster is attracted into the pot by bait and is unable to escape. The pot is then recovered by the vessel. <sup>1209</sup>

<sup>1209</sup> ibid p166

## Gill Net Fishing

This fishing is done by stretching a very fine net either, over the bottom, at midwater or on the surface. The nets have been known to extended over 50 nm. The catch is indiscriminate and this type of fishing has been outlawed in many countries.<sup>1210</sup> International opinion is against the use of gill nets and a UN Resolution has prohibited their use after December 1995.<sup>1211</sup> More than a thousand trawlers from eastern States such as South Korea, Taiwan, and Japan have been using gillnets to catch Squid, Tuna, Salmon, Albacore and Billfish. These fishing operations take place on the high seas with these nets which are about 10 metres deep and up to 50 km long. They are made in the form of a nylon monofilament curtain through which nothing larger than the mesh size can pass.



**Figure 69 FISHING METHODS**  
(Using lobster pots, long lines and gill nets )

<sup>1210</sup> Ross n137 p164-166

<sup>1211</sup> UN Resolution General Assembly [UNR 44/225](#) (1990)

This inevitable resulted in

*wasteful by-catch discards, entrapment of mammals and seabirds, potentially devastating effects on the ocean ecology and damage to marine life caused by lost nets.*<sup>1212</sup>

In May 1989, States party to the International Convention for the High Seas Fisheries of the North Pacific Ocean (Canada, Japan, and the United States) agreed on measures to control the Japanese gill-net operations by onboard inspections. Japan also agreed to control the number of vessels and the areas where this type of fishing would be allowed.<sup>1213</sup> In addition, co-operative actions by the US and Russia resulted in greater control of the indiscriminate catching of salmon.

The concern of the South Pacific States, in regard to this practice, resulted, in July 1989, in the Tarawa Declaration, which was adopted at the Twentieth South Pacific Forum. This Declaration confirms that this type of fishing is inconsistent with internationally accepted legal requirements for the conservation, protection, and management of high seas' fish resources. The Declaration sites in particular Articles 63, 64, 87, and 116-119 of LOSC.<sup>1214</sup> It is contended that this type of fishing is not in accordance with these Articles.

### BIOLOGICAL RESOURCES OF THE OCEANS

It has been said that fish provide only a small portion of the required world intake of animal protein.<sup>1215</sup> For the balance of the shortfall in animal protein to be obtained from the sea other sources would have to be considered. The oceans have an abundance of organic matter, but the identification of the best and most abundant source has not been made and little significant harvesting of other sources is undertaken.

### NON-RENEWABLE RESOURCES

All mineral resources, and oil, gas, and coal are non-renewable. It is anticipated that the percentage of oil taken from beneath the sea could be as high as 50% of total oil production by the year 2000.<sup>1216</sup>

The mineral resources of the oceans can be divided into four main categories;

- a) those elements dissolved in the sea water;
- b) those minerals that can be recovered from the underlying bedrock, such as coal or iron deposits;
- c) those minerals found on the ocean bottom;
- d) those mineral, such as oil and gas, within marine sediments.<sup>1217</sup>

Underlying bedrock, as indicated in c) is a very important source.

The minerals found on the ocean bottom can be further sub-divided into 5 categories;

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<sup>1212</sup> United Nations Report A/44/650 (1 November 1989) p33, Final Act of the Meeting on a Convention to Prohibit Driftnet Fishing in the South Pacific, including Text of the Convention for Prohibition of Fishing with Driftnets in the South Pacific and its Protocols- Wellington (24 November 24 1989) and Noumea, New Caledonia (20 October 1990) 29 ILM 1449 (1990)

<sup>1213</sup> ibid

<sup>1214</sup> ibid p34

<sup>1215</sup> ibid p155

<sup>1216</sup> Ross n137 p103

<sup>1217</sup> ibid p105

- a) minerals or sediments that normally constitute the sea floor, such as sand and gravel in shallow water and carbonate oozes and red clays in the deep sea;
- b) minerals that are concentrated by the actions of waves or currents, such as placer deposits;
- c) minerals formed by chemical precipitation from the sea water, such as manganese nodules, or from volcanic processes;
- d) deposits formed by biologic activity, such as reef rock, shells, or corals;
- e) deposits or pre-existing minerals that are now exposed by the eroding forces of the sea.

All of these 5 subdivisions, and three other main divisions could require specialised types of mining.

<sup>1218</sup> The minerals are usually classified by type and location of deposit.

There are three main oceanic zones or locations of deposit;

- a) those inside the coastal State's territorial waters in the nearshore zone;
- b) those on the continental shelf; and
- c) those on the deep sea-bed.

Minerals found on, or in, the deep sea-bed, could be mined as a resource of an exclusive economic zone, if the deep sea-bed is within 200 nm from the baselines. They can also be mined as a concession in the Area. <sup>1219</sup>

The types of minerals found in the continental margin, comprise

- a) elements in solution (including sea water),
- b) minerals recoverable from the underlying bedrock,
- c) minerals on the ocean bottom and
- d) oil, gas and sulphur. <sup>1220</sup>

### Major Sediment Types

Marine sediments have been described in Chapter VI but are also considered in this Chapter as they have a major influence on non-renewable resources.

They are divided into three types:

- a) those that are transported into the ocean as particles, are dispersed over the floor and settle (Lithogenous sediments);
- b) those that precipitate from solution (Hydrogenous sediments);

<sup>1218</sup> ibid p106

<sup>1219</sup> PM Bartlett & WCJ van Rensburg "Technical, Economic and Institutional Constraints on the Production of Minerals from the Deep Seabed" *Acta Juridica* (1986) p69

<sup>1220</sup> Ross n137 p107



- c) those that are as a result of deposition of organisms on the sea-floor (Biogenous sediment).<sup>1221</sup>

### **Lithogenous Sediments**

This material originates from the break-up of rocks and minerals onshore. It is transported into the sea by river, wind and glaciers and also as a result of volcanic eruptions. They are deposited in the sea and on the seafloor and are then redistributed by wave and current action. Beach and shelf sand usually originates as lithogenous deposits. The composition of the beaches is dependant on the source material and can vary substantially. The subsequent redistribution and therefore the shape of the beach or slope can also vary. (See Section 'Marine Currents' Chapter VI )

The sediment that is deposited initially on the shelf and later on the slope and rise is usually finer material and the initial characteristic is the formation of silts.<sup>1222</sup> It is also possible for clay to be laid down on the shelf, slope, rise and the deep seabed. These deposits are usually rich in organic material and later become important in oil exploration and exploitation.

### **Biogenous Sediments**

These sediments are deposited in an area either as a result of the creatures that inhabit the sea-floor (benthic organisms) or as a result of biogenic activity in the water column above it (pelagic organisms). These sediments occur, therefore, widespread over the seafloor, wherever these organisms are found. The distribution of the sediment on the seafloor is also by waves and currents. It is possible for sediment to consist of both biogenous and lithogenous components as a result of an overlap of sources. Nearly all calcium carbonate deposited on the seabed is as a result biogenous activity. The sedimentation of this material is important in the development of phosphatic type resources.

Plankton also contributes to the development of shelf and slope sediment. The contribution of plankton increases in relation to benthos the further seawards the sediment is found and are considered more typical of the deeper open ocean.<sup>1223</sup>

It is possible that not all carbonate precipitation is organism-associated. The precipitation could have occurred inorganically. Nearly all the inorganic carbon is in the form of bicarbonate. By a series of reactions this bicarbonate could result in deposition of carbonates.<sup>1224</sup>

### **Hydrogenous Sediments**

These sediments occur as a result of precipitation in the sea water column above an area. The deposition of the shells and skeletons that are considered biogenous could also be regarded as hydrogenous as they originate in the water column. They are organisms that have been classified as biogenous. Similarly phosphorites are essentially biogenous as all phosphorus is a part of biogenic life cycles.<sup>1225</sup>

### **Evaporites**

These sediments form as a direct result of the evaporation of sea water. The effect is enhanced in restricted waters like lagoons, bays or on certain types of shelf and where there is an extremely arid climate, such as the Persian Gulf. Gypsum and halite are some of the minerals contained in this sediment. Iron is a natural component in most areas, including the sea. Its presence in sediment is expected. The iron is affected by the amount of oxygen present and where a lot of organic matter is present, the oxygen content is low. This results in the precipitation of iron pyrites. In deeper water,

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<sup>1221</sup> Seibold n357 p78

<sup>1222</sup> ibid p80

<sup>1223</sup> ibid 84, Ross n137 p28-32

<sup>1224</sup> Keen n363 p70-78

<sup>1225</sup> Seibold n357 p90

where oxygen is usually more plentiful, the iron is oxidised into iron oxide.<sup>1226</sup> The deposition is widespread and re-dissolution is common.

### **Nearshore Zone Deposits**

Deposits in these areas include the following:

- a) phosphorite deposits off the west and east coasts of North America;
- b) similar deposits off the west coasts of South America and Africa and the Chatham Rise east of New Zealand;
- c) underground coal mines off the coasts of Canada, United Kingdom and Japan;
- d) placer deposits are deposited in the shallow coastal zones of most coastal States, such as diamonds off the west coast of South Africa and the tin of Malaysia;
- e) economically viable amounts of industrial sand and gravel are found in nearshore zones such as in the United Kingdom.<sup>1227</sup>

The minerals of the sea-bed can be categorised into three categories:

- a) minerals recoverable from the underlying bedrock;
- b) minerals in the ocean bottom;
- c) minerals within marine sediment.<sup>1228</sup>

The minerals found that fall within category c) can be

- a) minerals that normally constitute the seafloor, such as sand and gravel in shallow water and ooze and clays in deeper water;
- b) minerals resulting from the actions of waves and currents, such as placer deposits;
- c) minerals resulting from chemical precipitation, such as manganese nodules;
- d) minerals resulting from biological activity, such as those in reef rock and corals;
- e) pre-existing minerals that have become exposed as a result of erosion of the seafloor.<sup>1229</sup>

### **Continental Shelf Deposits**

Minerals found in the seabed on the LOSC continental shelf are generally categorised as follows:

- a) minerals resulting from sediment deposition on the shelf;
- b) minerals derived from the actions set in motion by waves and currents and variation in the level of the sea;
- c) minerals resulting from processes that occurred during the development of the margin and in particular the shelf.

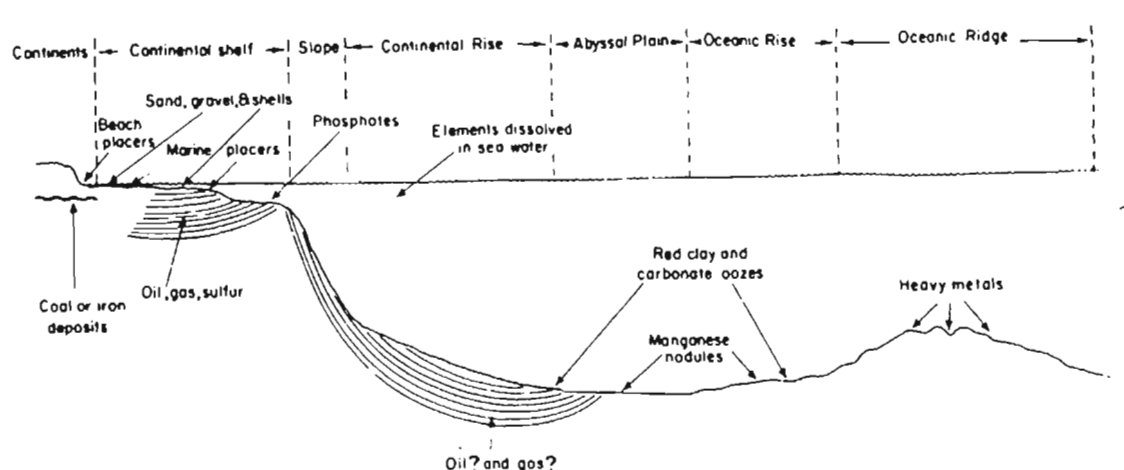
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<sup>1226</sup> ibid p92, Keen n363 p72

<sup>1227</sup> Ross n137 p108

<sup>1228</sup> ibid p105

<sup>1229</sup> ibid p106



**Figure 70** GENERAL AREAS WHERE MINERALS ARE FOUND IN SEDIMENTS ON, AND IN, THE SHELF, THE SLOPE, THE RISE, AND THE DEEP SEABED

### Sediments on the Shelf

Gold, platinum, titanium, chromium, tin, diamonds, rare earth and other heavy metals are frequently found on the marine-geological continental shelf of a coastal State and oil and gas is also found there. There are certain resources that are recoverable from sea water, such as magnesium compounds, magnesium metal. Bromine and salt can be produced in great quantities.<sup>1230</sup> Although there are more than 700 desalination plants throughout the world, the provision of fresh water from sea water, and the accompanying salts, has not been fully developed. This is not an operation that should be influenced by LOSC.<sup>1231</sup>

### Resources of the Continental Shelf

MINERALS	POTENTIAL SOURCE
Boron, Bromine, Calcium, Magnesium Potassium, Sodium, Sulphur and Uranium	Sea Water
Sand and Gravel, Phosphorite, Glauconite, Lime and Silica, Sand, Heavy Minerals (Magnetite, Rutile, Zircon, Cassiterite, Chromate, Monazite, Gold)	Sediment (Continental Shelf and Slope)
Copper, Lead, Silver, Zinc Oil, Gas, Sulphur	Heavy metal muds Subsurface (Continental Shelf, Slope and Rise)
Manganese nodules (Copper, Nickel, Cobalt and Manganese)	Deep Sea

**Table 3** MINERALS AND POTENTIAL SOURCES

<sup>1230</sup> Bartlett n1204 p69

<sup>1231</sup> Ross n137 p107

The above Table indicates some of the resources, and their potential sources, that could be found on a continental shelf.

### Seawater

Seawater is thought to contain traces of most of the elements found on land. These quantities are, in most cases, minute and their extraction would not be viable at this stage. As a by-product of the process of desalination, the extraction of these elements might become economical in the future. Ross is of the opinion that there are, in the oceans over 5 billion tons of uranium and copper 500 million tons of silver and 10 million tons of gold. The average concentration of these elements is thought to be minute.<sup>1232</sup>

The quantity of the elements contained in seawater varies enormously from chlorine at 18 980 ppm<sup>b</sup> to aluminium 0.01 ppm<sup>b</sup>. Also amongst the larger quantities found are sodium and magnesium.<sup>1233</sup>

### Seafloor

*..large deposits of metal ore form on the seafloor. In volcanic active regions of the seafloor-near the mid-oceanic ridge and submarine volcanoes-the hot rocks heat seawater as it circulates through the fractures in the oceanic crust. The rate at which seawater circulates through the ocean crust is equivalent to the entire combined volume of the oceans passing through once every 8 million years. The hot water dissolves minerals as it circulates through the oceanic crusts. Then as it rises through the upper layers of the oceanic crust, the metal-laden water cools.*<sup>1234</sup>

Some mining is as a result of minerals being discovered in the bedrock. As the mining progressed it became evident that the deposits extended seawards. In some instances, such as the coal mining of Japan and the United Kingdom and the bauxite mines of Australia, these mines were extended under the sea as an extension of the land-based mine.<sup>1235</sup>

Phosphorites occur usually in areas of palaeo-upwelling. As the nutrient-rich bottom water rises to the surface and becomes warm, the phosphate is precipitated.

Interstitial water occupies the space between sediment grains which forms a more or less coherent system of cavities and channels. This space is filled with interstitial, or pore water, or trapped seawater. The sediments are buried by additional new material and the pore space is reduced by compression. Some of the water is forced out. Chemical changes occur, both in the surrounding sediments and in the pore water. The oxidation of the organic carbon leads to the depletion of dissolved oxygen from the pore-water and this is replenished by stripping oxygen from dissolved nitrate and from solid iron oxides and hydroxides. In the process gases are produced, such as carbon dioxide, ammonia and hydrogen sulphide. The fermentation of the remaining organic compounds can lead to the formation of methane. When this reacts with water, clathrates are made.<sup>1236</sup> These are mainly located in the continental rise.

While some commentators are of the opinion that the recovery of these deposits would not be economical,<sup>1237</sup> others feel that the deposits are so substantial and of such a high grade, that it would be possible to recover the deposits by suction and they would require little processing. Sand-sized phosphorite pellets, off the Namibian coast, could be mined in this manner, but the deposits off the South African coast are more slab-like, and would need dredging.<sup>1238</sup>

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<sup>1232</sup> ibid p108

<sup>1233</sup> Seibold n357 p75

<sup>1234</sup> GR Thompson & J Turk Modern Physical Geology (2<sup>nd</sup> Ed) (1997) p238

<sup>1235</sup> Ross n137 p108

<sup>1236</sup> Baretta-Bekker n456 p164, Seibold n357 p76

<sup>1237</sup> Ross n137 p108

<sup>1238</sup> JM Bremner & J Rogers "Phosphorite Deposits on the Namibian Continental Shelf"

Phosphate Deposits of the World Vol 3 Neogene to Modern Phosphates WC Barnett & SR Riggs (eds) (1990) p143-152

The sediment thickness on the margins of coastal States varies considerably, but it is substantial. The origins of the sediments has been considered in Chapter IV. They have accumulated over a period of over 100 million years and can be more than 10 km thick. Original organic matter in these sediments could have been the source of oil and gas resources.<sup>1239</sup>

With the rise and fall, over the years, of the level of the seas and oceans, it is possible that minerals could have been deposited where they would not have been expected to be laid with the present configuration of margin and coast. With a falling sea-level the beaches are moved further and further seawards and nearshore types of sedimentation would be left in the deeper water as the sea-level rose again.<sup>1240</sup> This could also occur in submerged river valleys now on the marine-geological continental shelf, as the finer grains were carried seawards and deposited on the older, coarser, grains. This type of drowned nearshore deposit is called a placer and could contain valuable minerals, such as rutile, magnetite, ilmenite, zircon, platinum, and gold. Off the Namibian coast diamonds are found in placer deposits.<sup>1241</sup>

Sand and gravel, while not as valuable per ton as the other mineral resources, are equally as important, as they are extensively used in building and allied industries and are readily recoverable from the seabed in certain areas.

Other minerals found include calcium carbonate (calcite and aragonite in shell fragments), which can be used in agriculture and cement manufacturing if it is economical to mine from the seabed, and barite used in the petroleum drilling industry.<sup>1242</sup>

### Seafloor-Spreading Areas

At the mid-oceanic ridges, where seafloor spreading occurs, volcanic material is extruded at the ridge, as the new seabed is being formed. This volcanic material could result in heavy metals being deposited in the area. These would include minerals such as copper, zinc, iron, cobalt, manganese and others. It is thought that the deposits accumulate in reasonable quantities as a result of crystals forming in the cooling magma. These sink and are joined as subsequent crystals are formed. As the origin of the material is at the mid-oceanic ridge and as the spreading continues from this point out over the seafloor it is logical that these minerals must also have been transported with the spreading and even subducted when the crust was destroyed. It is possible, therefore, that the minerals located, at present, at the ridge could also be found generally over the seafloor.<sup>1243</sup> It is possible also that at the subduction zone hydrothermal fluids will rise and these minerals will accrete onto the continental crust.<sup>1244</sup>

Heavy metal deposits have been found in the Red Sea, a recent active spreading centre. There are several relatively small enclosed basins. The bottom of these basins is filled with hot salt brine with temperatures in the region of 60 degrees Celsius. The salinity is about seven times that of seawater. Although the minerals are very fine grained, there are estimated reserves of 3.2 million tons of zinc, 0.8 million tons of copper, 80 000 tons of lead, 4500 tons of silver and 45 tons of gold.<sup>1245</sup>

### Coal

Vegetation that dies and accumulates in areas where the oxygen is in short supply, such as marshes and bogs, will not decay. Additional material will fall on top and the branches will be rapidly buried under these twigs and leaves. This will prevent oxidation and as the material accumulates it turns into

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<sup>1239</sup> ibid p109

<sup>1240</sup> Ross n137 p110

<sup>1241</sup> ibid

<sup>1242</sup> ibid p114

<sup>1243</sup> ibid p115

<sup>1244</sup> ibid p116

<sup>1245</sup> Seibold n357 p297

peat, a soft brown porous mass of organic matter, where the original source-material is still evident. After further chemical transformation it could become lignite, a soft coal and eventually bituminous coal, which is harder, and then anthracite which is the hardest. The longer the material has to undergo transformation, via compaction at great depth, the harder the coal becomes and the greater the heat generated when burnt.<sup>1246</sup>

Coal forms in a non-marine environment and that which is found under the sea is thought to have originated at times when sea levels were much lower, or beds have subsided or they have been downfaulted. Low-lying coastal plains that had swamps and moors would eventually be underwater and this could lead to the formation of coal deposits in the sediment.<sup>1247</sup> It is present with other metals, such as iron ore and is mined from tunnels on the land. As mentioned earlier in this Chapter, this type of mining takes place in a number of countries, in particular Canada, the United Kingdom and Japan. In all these cases the initial discovery took place on land and when the sediment was seen to extend under the sea the mining operation was likewise extended.<sup>1248</sup> For this reason the limit of this type of mining operations is restricted to areas relatively close to the coast.<sup>1249</sup>

Slabs of phosphorite, consisting of the mineral carbonate fluorapatite (francolite), are sometimes exposed on the seabed and while they could be mined, the comparison between the costs of mining under water and the additional transportation costs from recovery site to the land, make the operation uncompetitive with present land-based operations. Phosphorite is usually used in the production of fertilisers and offshore recovery could be viable if the recovery site of the minerals is much closer to agricultural areas than the landbased alternatives.<sup>1250</sup> This is especially the case if the phosphorite is in the form of sand-size pellets, as off the coast of Namibia.<sup>1251</sup> The origin of the Namibian deposits is thought to be as a result of cold water, rich in nutrients, rising to the surface of the sediments due to upwelling. As the water is warmed and the pH increases the phosphate is precipitated in interstitial water of the seas.<sup>1252</sup>

## Oil and Gas

*Natural gas or methane (CH<sub>4</sub>) forms naturally when crude oil is heated above 100°C during burial. Many oil wells contain natural gas floating above the heavier liquid petroleum. In other instances, the lighter, more mobile gas escaped and was trapped elsewhere in separate reservoirs.*

*Streams carry organic matter from decaying land plants and animals to the sea, and some large lakes, and deposits it with mud in shallow coastal waters. Marine plants and animals die and settle to the sea floor adding more organic matter to the mud. Younger sediment then buries this organic rich mud. Rising temperature and pressure resulting from burial convert the mud to shale. At the same time, the elevated temperature and pressure convert the organic matter to liquid petroleum that is finely dispersed in the rock.*<sup>1253</sup>

Methane hydrates are solid, non-stoichiometric mixtures of water and gas methane. They occur world-wide in sediment beneath the seafloor and estimates of the total mass available there exceed 10<sup>16</sup> kg. Since each volume of hydrate can yield up to 164 volumes of gas, off-shore methane hydrate is recognised as a very important natural energy resource.<sup>1254</sup>

<sup>1246</sup> Press n358 p327

<sup>1247</sup> Seibold n357 p129-133

<sup>1248</sup> Ross n137 p108

<sup>1249</sup> Holt n1156 p259

<sup>1250</sup> Ross n137 p108

<sup>1251</sup> Bremner n1221

<sup>1252</sup> ibid

<sup>1253</sup> Thompson n1218 p43

<sup>1254</sup> EC Willoughby & RN Edwards "On the Resource Evaluation of Marine Gas-Hydrate Deposits Using Seafloor Compliance Methods" *Geophysical Journal International*, 131 (1997) p751

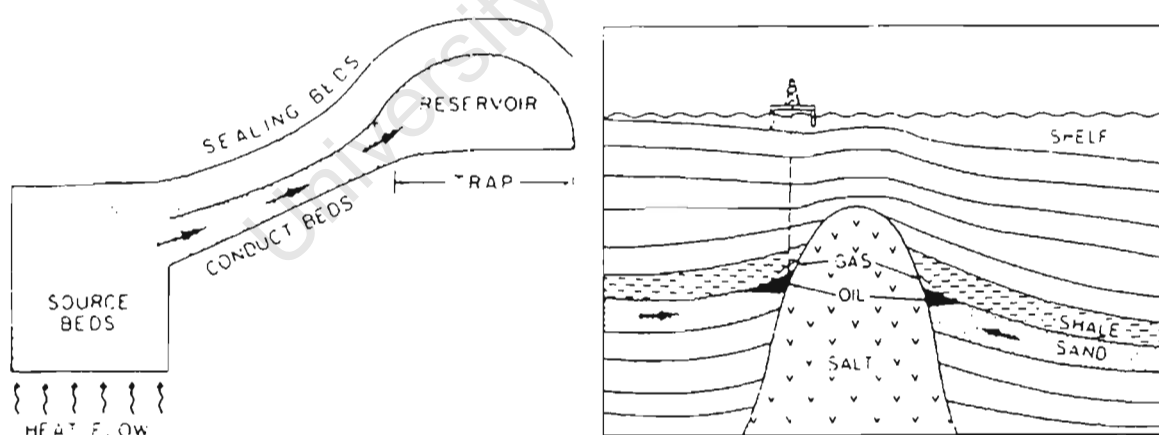
The migration of deep methane-bearing fluid is considered to cause the formation of marine gas hydrate. The gas hydrate must have nucleated and grown directly from an aqueous solution. Barriers associated with the nucleation process may impede or prevent the formation of hydrates. It is uncertain whether the hydrate can form in the sea floor from dissolved gas.<sup>1255</sup>

Oil and gas are regarded in some areas as the most important resources from the sea. Petroleum and gas originate from organic matter that lived originally in the sea or in rivers. When it died it was deposited on the seafloor. A chemical process converts this debris into oil over periods that could be up to 3 million years.<sup>1256</sup> This material will not become a potential oil source if it becomes oxidised. Where rapid deposition occurs or where the environment is oxygen-poor it is possible that the sedimentation process will allow the organic material to be buried in a condition which could lead to oil being formed. The conditions for the formation of oil are that the sediments must be buried sufficiently deeply and the organic material must not be heated too much. The duration of the process is unknown but hydrocarbon deposits are rarely found in rocks that are younger than 2 million years old.<sup>1257</sup>

When the oil starts to form it begins a migration to porous rocks such as sandstone or reef deposits. These rocks are called reservoir rocks.<sup>1258</sup>

*Many oil-traps form where impermeable cap rock prevents the petroleum from rising further. Oil or gas then accumulates in the trap as a petroleum reservoir. The cap rock is commonly impermeable shale. Folds and faults create several types of oil traps. In some regions large lightbulb-shaped bodies of salt have flowed upward through solid rocks to form salt domes. The rising salt folded the surrounding rock to form an oil trap<sup>1259</sup>*

It is estimated that less than 0.01% of organic matter in sediments becomes concentrated into oil or gas. For the matter to be converted into fluid petroleum the sediments must be at least 1000m thick and there must be a temperature of 50-100 degrees C. Long periods of reaction may compensate for low temperatures.<sup>1260</sup> If the temperature rises too high, the oil could become gas. As the marine sediments overlie salt which is gravitationally unstable, the salt forces it way upwards into domes. This is because the salt is less dense than the overlying sediments. This dome creates pressure against the sediments and provides traps for the petroleum to collect.<sup>1261</sup>



**Figure 71 OIL AND GAS TRAPS AND RESERVOIRS IN SEABED SEDIMENTS**

<sup>1255</sup> BA Buffett & OY Zatssepina "Formation of Gas Hydrate from Dissolved Gas in Natural Porous Media" *Marine Geology* 15 March 1999 p69

<sup>1256</sup> Ross n137 p119

<sup>1257</sup> ibid

<sup>1258</sup> ibid

<sup>1259</sup> Thompson n1218 p432

<sup>1260</sup> Seibold n357 p280

<sup>1261</sup> ibid

Salt domes provide a path for petroleum migration.

*Salt deposits, of course, also are well known from the Gulf of Mexico, where they push up salt domes (diaspirs), providing a path for petroleum migration.*<sup>1262</sup>

Oil is also trapped in the region of faults where organic-rich strata formed at a time of upwelling and oxygen deficiency. In the thick sediments in the North Sea the sediments are in an inactive rift system. High rates of subsidence and sedimentation resulted in the formation of substantial oil and gas deposits.<sup>1263</sup>

The first results of the process are considered to be viscous type of oils. After a period of time these are further broken down into smaller droplets. The process may commence in sediments of a fine-grained or clay nature which absorb the oil and are known as 'source rocks'. Oil is seldom found in these areas as it usually migrates to rocks that are more coarse-grained.<sup>1264</sup>

Oil and gas are hydrocarbons and are usually found in the sediments formed on the continental shelf. It is possible that they could also be found in other sediment areas such as the continental rise, but technology has not made the exploration of sediments at these depths viable at this time.

The potential for these resources to exist is usually unknown. As an example it was reliably considered that oil and gas reserves would not be found on the southern African continental shelf. Extensive exploration of the submarine basins off the southern African coast has indicated, however, the potential of the following basins.

#### **Orange Basin**

The Orange Basin has good hydrocarbon potential.

*Gas has been found in the drift succession and oil in the synrift succession. (see footnote 1265)*

#### **Bredasdorp Basin**

The Bredasdorp Basin, which covers approximately 18 000 sq kms with water depths less than 200 m, contains a gas field that became South Africa's first producing field.

#### **Pletmos basin**

The Pletmos basin which is 20 000 sq kms in extent has encouraging gas shows.

#### **Gamtoos and Algoa Basins**

The Gamtoos and Algoa Basins have evidence of regional hydrocarbon potential.

#### **Outeniqua Basin**

The southern Outeniqua Basin encompasses the distal extensions of the Pletmos, Gamtoos and Algoa Basins beyond the 300 metre isobath and are

*expected to contain good quality stacked reservoir sandstones. (see footnote 1265)*

#### **Durban and Zululand Basins**

The Durban and Zululand Basins are relatively unexplored and their potential is unknown.

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<sup>1262</sup> ibid p48

<sup>1263</sup> ibid p282

<sup>1264</sup> ibid p119



*SOEKOR's exploration efforts have conclusively demonstrated that South Africa's offshore sedimentary basins possess significant hydrocarbon potential.*<sup>1265</sup>

Oil is often found in deltas due to the accumulation in basins of sediments brought down by the river and deposited in the area. This sediment is usually high in organic matter.<sup>1266</sup> Oil exploration is usually directed, therefore, to areas where the marine sediments are thick and interspersed with coarse layers. The extent of the resources is difficult to survey, due to the fact that they are in the subsoil covered by water and in some instances at great depth. The activities involved in sea-mining operations are far more expensive than land-based operations. In addition the survey or mining may have to take place in extremely inhospitable conditions.<sup>1267</sup>

As a renewable asset that has been extensively exploited on land, oil found in off-shore areas is becoming an increasingly more valuable asset. As technology progresses it is becoming possible to mine at deeper depths and the exploration and exploitation of oil in off-shore areas will become an increasingly important factor in delimitation negotiations.<sup>1268</sup>

### **MINERALS IN THE CONTINENTAL RISE**

It is possible that in the future, oil will be economical when found and exploited on the continental rise. The sediments in this area could equally have been under the conditions necessary for the formation of hydrocarbons. Studies have revealed that salt domes, capable of acting as traps for oil or gas as shown in Figure 70 above, have been found on the continental rise.<sup>1269</sup> These salt domes may have been formed from salt that was deposited during times when basins were in an evaporitic state. Sulphur may be found in the cap of a salt dome and some of these resources are capable of economical yields. Because of the sedimentary process necessary to produce hydrocarbons it is considered unlikely that oil and gas deposits will be located on the deep sea bed.

*Clathrates can be formed when water (with given low temperature and high pressure) reacts with methane gas formed from the fermentation of organic carbon compounds. Clathrates could be widespread below coastal upwelling regions producing seismic reflections.*<sup>1270</sup>

### **RESOURCES IN THE DEEPSEA BED**

Although the deep seabed comprises nearly 80% of the ocean, its mineral resources are considerably less than found on the continents and seawards to the end of the rise. The main mineral resources are thought to be those contained in manganese nodules, in deep sea oozes and muds and at the oceanic ridges.<sup>1271</sup>

#### **Deep Sea Muds and Oozes**

A large proportion of the deep sea floor is covered with fine-grained mud deposits usually known as 'brown clay', 'red clay', or 'pelagic clay'.<sup>1272</sup>

#### **Brown Clay**

This clay has a very slow accumulation rate of a few millimetres per thousand years. It is very rich in aluminium, iron and with amounts of copper, nickel, cobalt and titanium as well. Such clay is regarded as being more enriched than the normal deposits found on land. The clay consists of

<sup>1265</sup> DB Broad & SR Mills "South Africa Offers Exploratory Potential in Variety of Basins" Oil and Gas Journal (December 1993) p1-8

<sup>1266</sup> Ross n137 p127

<sup>1267</sup> ibid p105

<sup>1268</sup> ibid p121

<sup>1269</sup> ibid p128

<sup>1270</sup> Seibold n357 p76

<sup>1271</sup> ibid p132

<sup>1272</sup> Baretta-Bekker n1227 p261, Ross n137 p133, Seibold n357 p218

extremely fine grained material of a complex composition. It can contain particles originating in the ocean, hydrogenous minerals, volcanogenic debris, ferromanganese concretions, and traces of biogenous particles such as fish teeth, arenaceous forams and in some cases spicules and radiolarians.<sup>1273</sup> They are at depths below the Carbonate Compensation Depth (CCD) and the calcite is removed by dissolution. Below approximately 5000 metres, the CCD, the calcite is dissolved into seawater chiefly the Antarctic Bottom Water (AABW).

The problem of mining an asset considered to extend over an area of approximately 40 million square miles, but at a depth of about 6000 metres, will eventually become a viable proposition.<sup>1274</sup> Although they rarely accumulate to thicknesses in excess of a few hundred metres. This clay has been shown to contain reasonable quantities (6%-9%) of aluminium and iron and smaller amounts of copper, nickel, cobalt and titanium. Because it has now been shown that these deposits are more concentrated than some land-based equivalents and it may become viable to mine them.<sup>1275</sup>

## Oozes

### Calcareous Ooze

These oozes could be located on top of, and shallower than, the red clay and derive their calcium from the influx of calcium from rivers and hydrothermal alteration of basalt on the seafloor. Calcite and aragonite (carbonate) is precipitated mainly in surface waters within the skeletons of organisms and are deposited on the seafloor when the organism dies. The calcium carbonates are preserved on elevated positions and dissolved on deeper areas by pressure and the decrease in temperature.<sup>1276</sup>

### Siliceous Ooze

The ooze is made up of the remains of diatoms, silicoflagellates, radiolarians and sponge spicules.<sup>1277</sup>

### Deepsea Bed Deposits

Marine manganese deposits and polymetallic sulphides are the two major categories of deposits that are found on the deep seabed. Valuable metals are contained in manganese nodules that are recoverable from the deep seabed. Included in these metals are nickel, copper, cobalt, and manganese. The importance of these metals can be noted from the facts that 23% of nickel is used in chemical plants and petroleum refineries, 13% is used for electrical appliances and a further 12% in motor vehicles.<sup>1278</sup> 57% of copper is used in the electrical industry, 15% in the building industry, 15% in the engine production market and a further 23% and 20% in the aerospace and tool manufacturing industries.<sup>1279</sup> Manganese is used in the manufacture of special steels for transport and building components. The main economically viable deposits of these nodules are found in the northern Pacific and are estimated to be about three quarters the land-based deposits.<sup>1280</sup>

Cobalt is also found in the cobalt crusts of basalt in the mid Pacific Ocean, but the extent of these resources has not been accurately quantified. The estimated value of the nodules was the reason, firstly, for the provision of the International Seabed Authority in LOSC<sup>1281</sup> and, secondly, for the reluctance of the States that had been involved in the exploration of these resources to

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<sup>1273</sup> Seibold n357 p222

<sup>1274</sup> Ross n137 p133

<sup>1275</sup> ibid p133

<sup>1276</sup> Seibold n357 p225

<sup>1277</sup> ibid p231

<sup>1278</sup> HH Bernhard & E Blissenbach "Economic Importance" The Manganese Belt of the South Pacific: Geological Environment, Nodule Formation, and Mining Aspects P Halbach, G Friedrich and U von Stackelberg (eds) (1988) p4

<sup>1279</sup> ibid

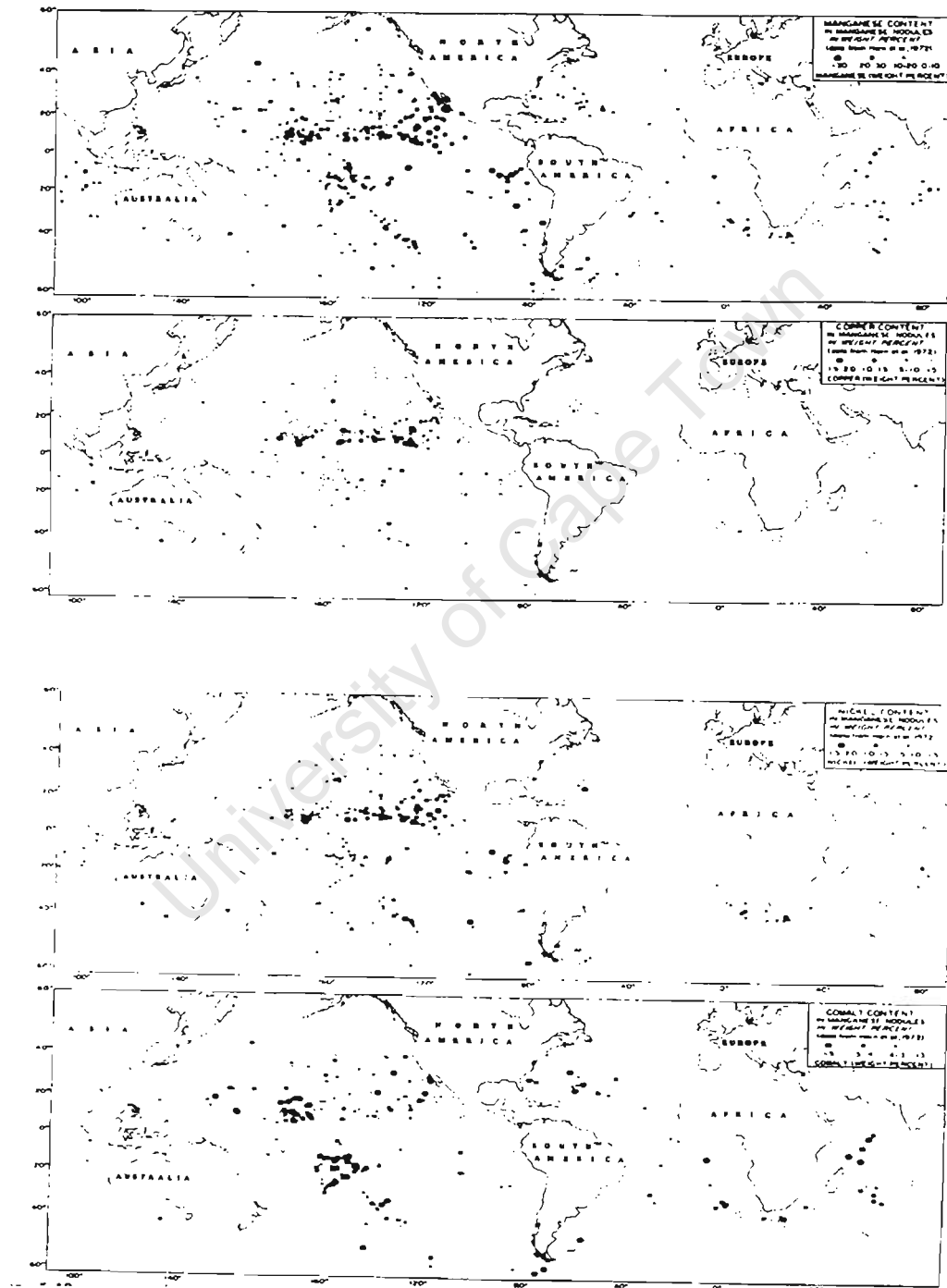
<sup>1280</sup> ibid p5

<sup>1281</sup> C Welling The Developing Order of the Oceans RB Krueger & SA Riesenfeld (eds)(1984) p267

become parties to LOSC. (See Figures 72 & 73 These maps reflect information available in the 1970s and serve only to indicate the possible world-wide distribution of minerals on the deep seabed.)

### Manganese Nodules

The necessity to mine manganese nodules has decreased with the fall in demand and this has resulted in a change in attitude by these States and a special agreement on the implementation of Part XI of LOSC, which deals with deep seabed mining, has been almost unanimously signed by all UN Member States. This agreement will be considered in Chapter XII.



The main mineral resource of the deep seabed is probably manganese nodules. The estimated value of these nodules was probably responsible for the drafting of Part XI of LOSC. This Part deals specifically with deep seabed mining and has only recently, as a result of an agreement<sup>1282</sup> being signed by the majority of States, been regarded as being internationally acceptable. During the 1980s the price of manganese fell on the international markets and the need to explore and exploit it became less urgent. The nodules are usually found as round nodules or as slabs known as 'pavements'. These nodules result from the accumulation of ferromanganese oxide around a nucleus, e.g. a small rock, and grows outwards in concentric rings. They consist of iron and manganese oxides, but they are sought, principally, for their accessory elements, copper, nickel and cobalt. They occur on the deep seabed of most oceans not on the abyssal plains where sedimentation rates from turbidites are too high.<sup>1283</sup> Growth is estimated at about 1 mm per 1 million years. This would not be possible if it were buried in sediment. The concentration in some areas is estimated to be very high and could be as high as 300 000 tons per square mile.<sup>1284</sup>

Industrialised nations became increasingly aware of the value of the metals contained in the ferromanganese seabed deposits and in particular the nodule metals such as nickel, copper, cobalt and manganese. Evidence was sufficient to indicate that thousands of square kilometres of seabed had nodule coverage equivalent to 10 000t/km sq.<sup>1285</sup> The estimated extent of these deposits gave rise to great concern that these resources, which are beyond the sovereignty of coastal States, would be exploitable by only the wealthy industrialised States.

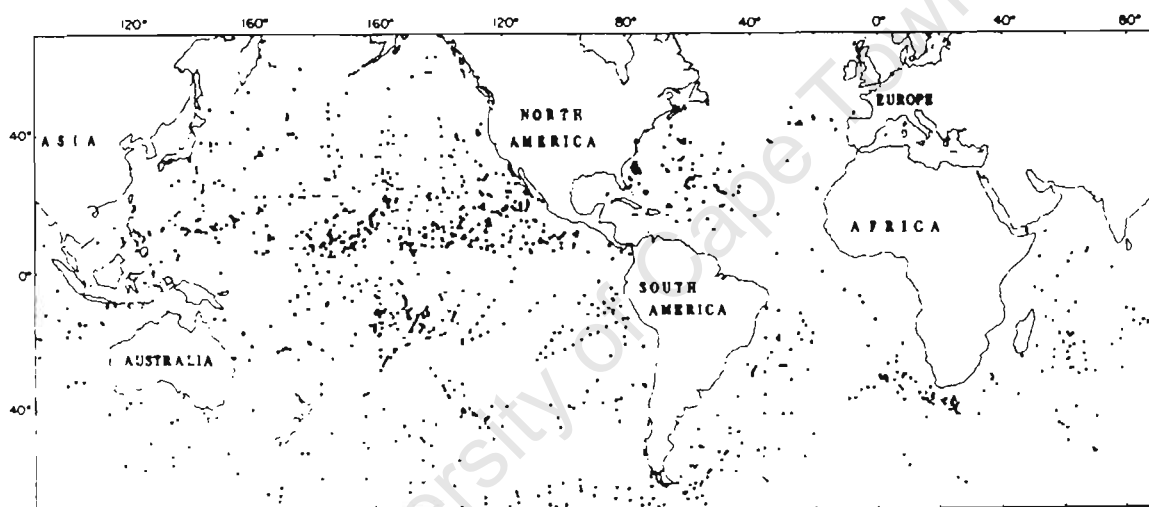


Figure 73 INITIAL ESTIMATES OF SIGNIFICANT FERROMANGANESE NODULE DEPOSITS ON THE DEEP SEABED

### Ferromanganese Crusts

Ferromanganese crusts are rich in cobalt and it is possible that platinum metals could also be present. Whereas manganese nodules have long been regarded as a valuable asset, these crusts have only in recent times been given consideration.<sup>1286</sup> The crusts are usually concentrated in areas where there are large variations in the depth of the water. They are therefore attached to volcanic basalts found in formations like sea-mounts. These are found to have the most chance of being commercially viable. Some authors regard the economic potential of the crusts as exceeding that of nodules.<sup>1287</sup>

<sup>1282</sup> UN Agreement on the Implementation of Part XI signed 27 July 1994

<sup>1283</sup> HW Degenhardt *Maritime Affairs-A World Handbook* (1985) p146

<sup>1284</sup> Ross n137 p140 Bartlett n1204 p69

<sup>1285</sup> Bernhard n1258 p2

<sup>1286</sup> Bartlett n1204 p71

<sup>1287</sup> *ibid* p72

## Polymetallic Sulphides

These sulphides are usually enriched in copper, zinc, lead, iron, gold and silver. They are related to the spreading that takes place on the seabed as a result of tectonic activity. They form as a result of hydrothermal activity that occurs at the seafloor-spreading centres. The deposits occur as the seawater enters fractures in the volcanic rock and comes in contact with magma. Metallic ions are leached from the volcanic rock as the circulating water returns to the seafloor. The solution circulates and the metals are concentrated as a result of other geological processes such as precipitation and ionic absorption. As the entire process can occur at plate boundaries which are convergent, slight differences in the quantities and distribution have been observed.<sup>1288</sup>

## EXPLORATION AND EXPLOITATION METHODS

Explorationists seek thick sequences of marine sediment with layers that are of coarse material. As discussed it is these coarse material layers that act as permeable reservoirs for oil. Drilling is required to confirm the presence of either oil or gas and production may only start much later.<sup>1289</sup> Floating platforms are being employed and by using a sonar transmitter placed on the seabed and by using computer-controlled thrusters fitted to the platform, they are able to maintain position over drill sites. This presupposes that weather conditions allow this to take place.

It has been possible to drill to water depths, to depths of 1500 metres. Once a drill hole has proved successful however a series of valves have to be connected to the hole at the level of the seabed. These valves were originally known as 'Christmas trees' (See Figure 66)<sup>1290</sup> and projected from the bottom to a height of 5 metres. At shallow depths it was possible to fit the valves using divers. At medium depths the divers could use submersibles and it is possible that for the deeper wells a submersible could also be used. It is not only the problems of drilling at great depths, but also the control of the well after it has been proved economically viable, that may prove very difficult at this stage. Seismic surveys are the most successful method of determining potentially viable sediments.

Electrical (usually electrical-conductivity) and gravity surveys are the most successful methods to locate minerals. These methods are used to determine underground structures and sometimes specific ores.<sup>1291</sup> Side-scan, remote-sensing devices, television cameras and submersibles are also used. Where the mineral lies on the surface of the seabed, like manganese nodules the exploration to locate areas of concentration is simpler. Vast areas of the seafloor contain various minerals in economic quantities. (See Chapter VI)

As the polymetallic sulphides are to be found in areas of crustal spreading the surveys are directed to those areas and are usually successful in locating economically viable deposits.

## MINING

The mining requirements for offshore operations are, in many instances vastly different from those of land-based operations to recover the same mineral. Every aspect of such an operation is more expensive than that on land. The offshore operation must usually take place from a vessel. Even the early stages of oil drilling and production platforms that are capable of being fixed to the seabed, commence aboard vessels specifically designed for the job. These vessels should be as stable as possible. The depth at which this can be achieved is usually less than 400m. This restricts operations of this nature to the shelf. The exploration that will subsequently lead to the exploitation of the various minerals is equally varied.

Elaborate techniques have been developed to recover manganese nodules from the seabed and at least one vessel, *R/V Deep-Sea Miner*, has been specifically built to mine nodules. The mining system is complicated and substantial. The vessel tows a bottom dredge with various trusses, weights, valves

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<sup>1288</sup> Seibold n357 p295

<sup>1289</sup> Ross n137 p121

<sup>1290</sup> South African Annual Notices to Mariners (1998) p40-41

<sup>1291</sup> Press n358 p606

and cables. In addition, the intention is for an ore-carrier to also be towed astern to receive the manganese nodules that would be piped to it from the recovery vessel.<sup>1292</sup>

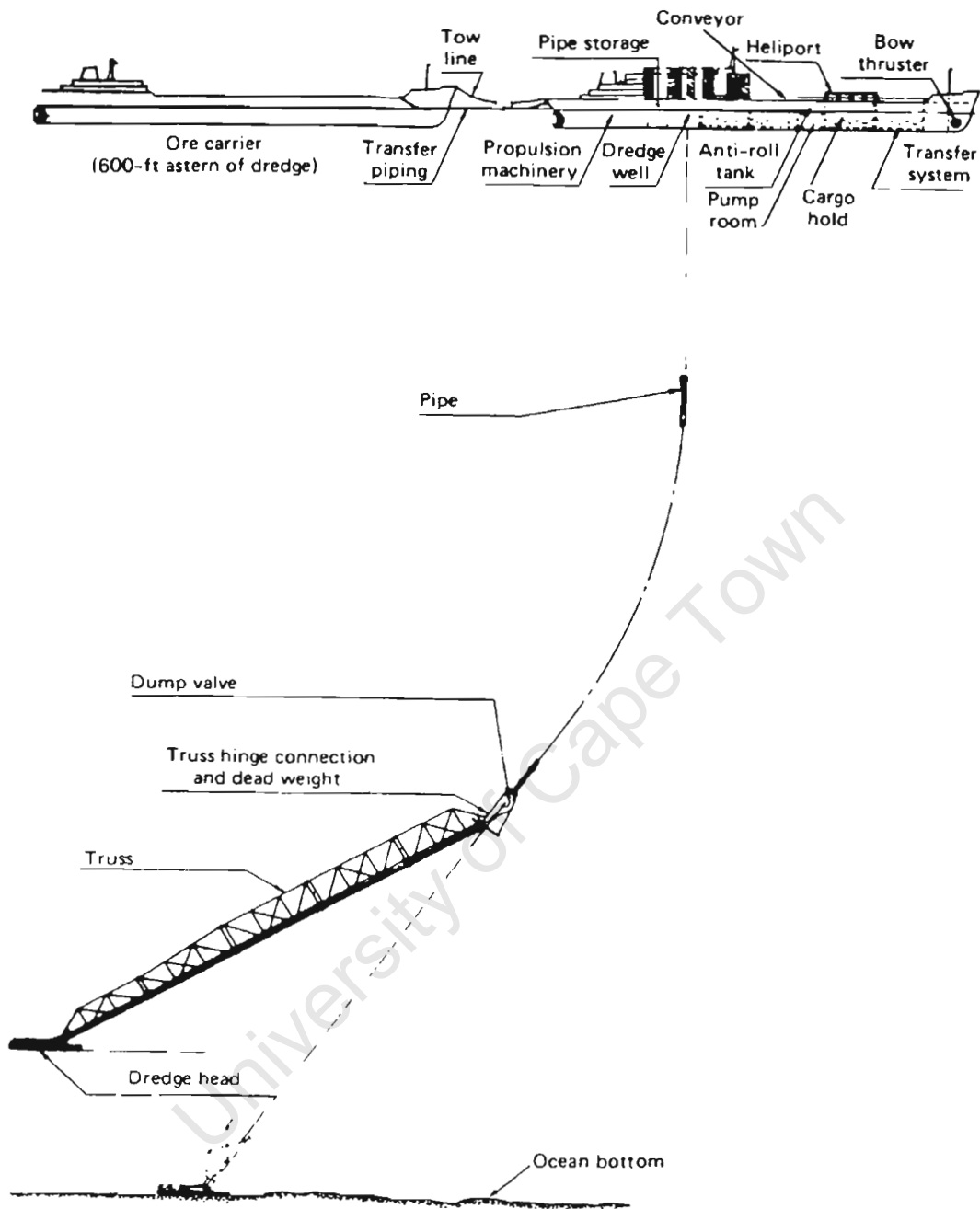
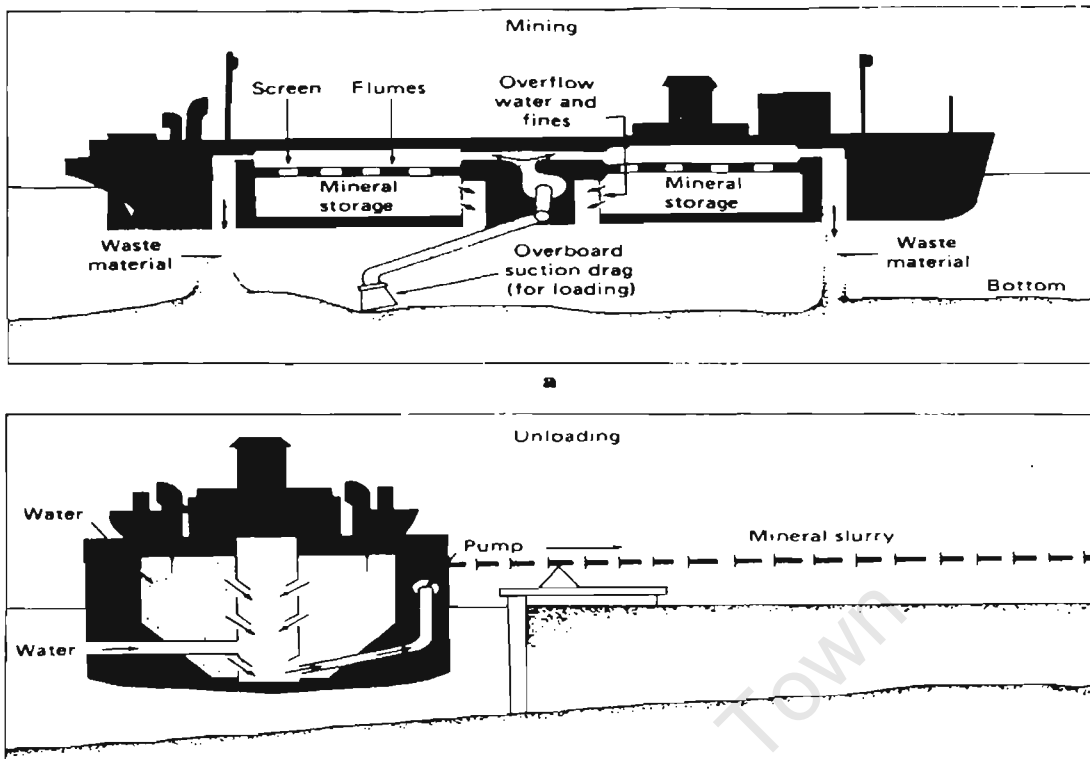


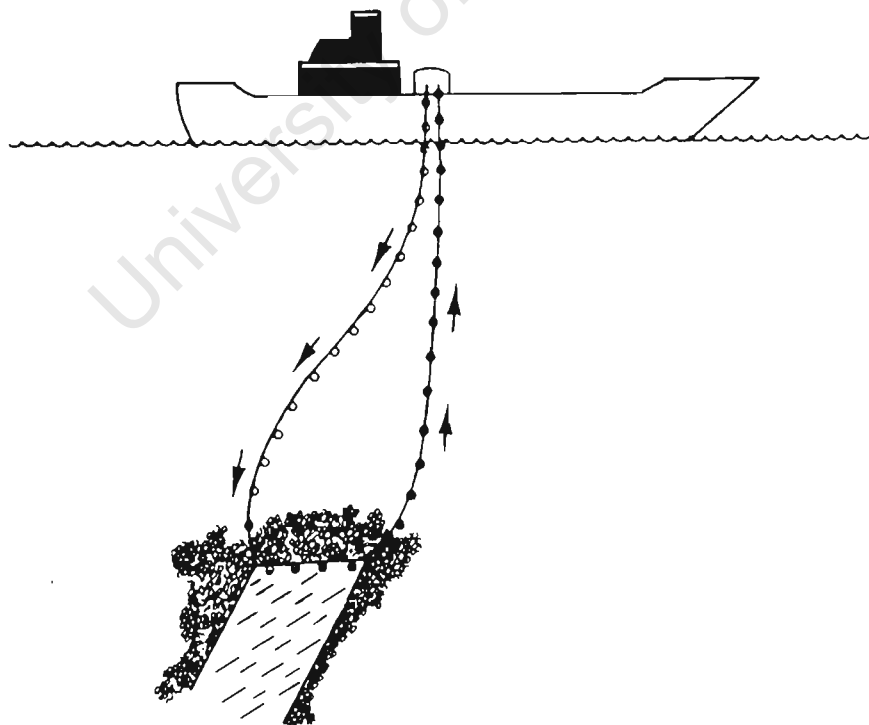
Figure 74 MINING MANGANESE NODULES BY PUMPING THEM TO THE SURFACE FROM THE DEEP SEABED

<sup>1292</sup> Ross n137 p146



**Figure 75 SHIPBORNE SUCTION MINING SYSTEM**

A simpler continuous line bucket (CLB) system has also be in use. <sup>1293</sup>



**Figure 76 MINING USING A CONTINUOUS SYSTEM OF BUCKETS**

<sup>1293</sup> ibid p148

The resources of the sea, the seafloor and the subsoil are therefore substantial. Oil, gas and minerals however are not yet subject to the necessary controls. LOSC has the potential to ensure a certain amount of control until more and more if not all States are party to LOSC. It is fortunate that the price of metals, in particular manganese, is such that it has not been economical to exploit marine manganese resources at this stage.

Oil exploration, exploitation and transportation does create a hazard not only of over-exploitation but also the ever-increasing hazard of pollution. Pollution will be considered in more detail in Chapter XII. Other than by its inclusion in the general clause of marine resources, oil is not mentioned in LOSC specifically. In Article 42(1)(b) the only mention of oil is in the context of transit passage in straits and the threat of the discharge of oil.

Minerals enjoy greater attention in LOSC in particular in regard to activities in the Area.(high seas) In Article 151(7) a number of minerals, copper, cobalt, nickel, and manganese are named. The Articles of LOSC that deal with resources are found in Part XI, The Area.

A major factor of exploration or exploitation of the resources of the sea is pollution. In addition the sea is being used an ever greater extent in its historic role as an avenue for world transportation. This carries with the ever increasing threat of pollution as well. (See Chapter XII)

## PART XI

LOSC Part XI controls the exploration and exploitation of the seabed, ocean-floor and the subsoil thereof. This Part is important and as many organisations may be created in accordance with Part XI these will be considered in greater detail in Chapter XII. Interesting definitions appear at the beginning of this part.

*For the purposes of this Part:*

a) 'resources' means all solids, liquid, or gaseous mineral resources in situ in the Area at or beneath the seabed, including polymetallic nodules;

b) resources when recovered from the Area are referred to as 'minerals' <sup>1294</sup>

The Area had itself been defined in the first paragraph of the first Article of the LOSC.

*For the purposes of this Convention;*

'Area' means the seabed and ocean floor and subsoil thereof, beyond the limits of national jurisdiction; <sup>1295</sup>

It means therefore that if the Area extends up to the limit of national jurisdiction this will vary from State to State. In Antarctica, where there are internationally disputed national claims to territory, the Area will extend to the low-water-line where there are no territorial claims.

An agreement on the implementation of Part XI has been entered and is considered in Chapter XII.

States party to LOSC may not claim sovereignty to any portion of the Area or its resources. This means that all mineral resources on the seabed or in the subsoil, outside the limits of a State's exclusive economic zone and LOSC continental shelf claim are the property of the Authority which

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<sup>1294</sup> LOSC Article 131

<sup>1295</sup> LOSC Article 1(1)



governs the Area. Minerals in suspension in the sea water are the property of a coastal State when they are in the exclusive economic zone of that State but it would appear that there is no authority over these minerals in suspension over the continental shelf of a State or over the Area.

### **OTHER STATES ENTITLED, BY LOSC, TO RESOURCES IN MARITIME ZONES**

The non-living resources in the exclusive economic zone of the coastal States in the region need not be shared with any other State as an obligation of LOSC.

Living resources are treated differently however, and landlocked and geographically disadvantaged States may be able to participate in the exploitation of any surplus of these resources. These will also, however, be subject to bilateral or regional agreements.<sup>1296</sup>

With justification disadvantaged States have held that the seaward extension of coastal States rights to the exclusion and detriment of other States could no longer be accepted. Most States have accepted that a more liberal approach to the rights of all States should be adopted and that the resources found in the maritime zones should be equitably harvested and distributed.<sup>1297</sup>

Should a State enjoy 'most favoured nation' status, as contained in the United Nations Charter, this status will not be affected as a result of the application of the LOSC Articles dealing with landlocked and geographically disadvantaged States.<sup>1298</sup>

### **Landlocked States (See also the Glossary Chapter VI)**

The additional rights of landlocked States to participate in the harvesting of surplus mobile resources found in the Exclusive Economic Zone of a coastal State could require careful and detailed bi-lateral agreements to safeguard the interests of the States concerned.<sup>1299</sup> The participation by a landlocked State in the surplus living resources would have to be on an equitable basis and agreements could be sub-regional, regional as well as bi-lateral.

Article 69 establishes the principal rights of landlocked States. The relevant sections of this Article are as follows

- a) They may participate, on a equitable basis, in the exploration of the surplus living resources of the exclusive economic zone of a coastal State of the same region or sub-region. The relevant economic and geographical circumstances of all States must be taken into account.
- b)
  - i) The agreements entered into must not affect adversely the fishing interests of the coastal State
  - ii) the extent of the landlocked States participation must be stated in the agreement,
  - iv) the extent to which other landlocked States are already participating in the coastal States resources, coupled now with the additional requirements must not prove too onerous for a single coastal State,
  - v) the nutritional needs of the populations of all the coastal States must be considered.
- c) If a coastal State is capable of harvesting its entire allowable catch then the states in the region are expected to enter into agreements for their participation as well.

<sup>1296</sup> LOSC Article 69(5) Churchill n18 p280

<sup>1297</sup> Brittin n945 p163

<sup>1298</sup> LOSC Article 126

<sup>1299</sup> LOSC Article 69

- d) Developed landlocked States are entitled to participate in the living resources of developed coastal States in the region with consideration being given to the fishing communities of the States that have traditionally or historically fished in the region.
- e) Existing agreements between a coastal State and landlocked States in the region are not prejudiced by the subsequent agreements.

In terms of LOSC, States that can be classified as being 'landlocked' or 'geographically disadvantaged', have certain rights to the resources of coastal States.<sup>1300</sup> In addition landlocked States have certain rights, in LOSC, over 'transit' States, when exploiting these resources, or when trading.<sup>1301</sup>

The definitions in LOSC applicable to the landlocked States are as follows:

- a) A 'landlocked' State means a State which has no seacoast.<sup>1302</sup>
- b) A 'transit' State means a State, with or without a seacoast, situated between a land-locked State and the sea, through which traffic in transit passes.<sup>1303</sup>
- c) For the purposes of this Part "geographically disadvantaged States" means a coastal State, including States bordering enclosed or semi-enclosed seas, whose geographical situation makes them dependent upon the exploitation of the living resources of the exclusive economic zones of other States in the subregion or region for adequate supplies of fish for the nutritional purposes of their populations or parts thereof, and coastal States which can claim no exclusive economic zone of their own.<sup>1304</sup>

LOSC makes provisions for landlocked and geographically disadvantaged States to have, access to ports, transport services, the laying and maintaining of pipelines and cables, and exemption from customs and excise duties when in the process of exploiting the excess resources in the exclusive economic zone of a coastal State.<sup>1305</sup> Although the coastal State has control of the resources in its exclusive economic zone there are requirements that the State;

*The coastal State shall determine the allowable catch of the living resources in its exclusive economic zone.*<sup>1306</sup>

*... shall ensure through proper conservation and management measures that the maintenance of the living resources in the exclusive economic zone is not endangered by over-exploitation.*<sup>1307</sup>

The coastal State is also obligated to promote the utilisation of living resources.<sup>1308</sup> This infers that the optimum harvest should be made and that the coastal State is unwilling or unable to achieve this optimum level of harvesting. It should then make some of these stocks available to landlocked States in the region to harvest.<sup>1309</sup>

<sup>1300</sup> LOSC Article 69/70

<sup>1301</sup> LOSC Articles 124, 125, 127-130

<sup>1302</sup> LOSC Article 124(a)

<sup>1303</sup> LOSC Article 124(b)

<sup>1304</sup> LOSC Article 73(2)

<sup>1305</sup> LOSC Article 58

<sup>1306</sup> LOSC Article 1(1)

<sup>1307</sup> LOSC Article 61(2)

<sup>1308</sup> LOSC Article 62(1)

<sup>1309</sup> LOSC Article 62(2)

The balance of the Article includes clear requirements for the coastal State in regard to the conservation of the living resources in the zone.<sup>1310</sup> Other States are required to comply with all measures and conditions laid down by the coastal State as conservation measures and licensing and regulations contained in LOSC must be complied with.<sup>1311</sup> These other States are required to comply with all measures and conditions laid down by the coastal as conservation measures and the licensing and regulations laid down in LOSC must be complied with.<sup>1312</sup>

Internationally accepted research has determined that each species has a level to which it may be depleted and the normal reproduction of the species will ensure its continued existence. This has become known as 'maximum sustainable yield' (MSY). It has become the most central factor in fisheries management.

The argument in opposition to this has come from the free market protagonists. They argue that a vessel will be able to achieve maximum effort by harvesting to a level known as 'maximum economic yield'. (MEY). This mean that if MEY is exceeded there is economic waste and if the harvesting is below MSY biological waste will occur.<sup>1313</sup> The difference between MSY and MEY could be a factor in the preservation of the species. In addition to MSY other factors of a socio-political nature must be considered when deciding on the levels that may be harvested.

It is possible for the coastal State, using its own or contracted assistance, to harvest all available stocks up to the optimum levels already determined. LOSC contains certain obligations for the coastal State in regard to certain categories of fish. Nothing prevents the coastal State from contracting other States to fish in the zone on its behalf. LOSC give rights to land-locked and geographically disadvantaged States to participate on an equitable basis, in the exploitation of an appropriate part of the surplus of the living resources in the exclusive economic zone.<sup>1314</sup> In southern Africa there are five possible six landlocked States that may wish to exercise this right now that the RSA has ratified LOSC. They are Lesotho, Swaziland, Botswana, Zimbabwe, Zambia and possible Malawi. It is difficult to consider how those Articles of LOSC dealing with landlocked and geographically disadvantaged States will be implemented when there are so many of these States wishing to participate should there be excess stock in Angolan, Namibian, South African, Mozambican and Tanzanian exclusive economic zones.<sup>1315</sup>

Who will decide what the equitable basis is and what States fall into the category of 'other States concerned'<sup>1316</sup> will be difficult to resolve. This would fall under the category of 'dispute settlement' under LOSC

In accordance with LOSC international organisations that intend undertaking research in the Area have to advise the landlocked and geographically disadvantaged States as well as the coastal States.<sup>1317</sup> This research is usually resource related. The landlocked States may also participate in the research programmes and they are entitled to the results of the research conducted.<sup>1318</sup>

States generally are expected to promote the development of marine research and technology particularly among the landlocked and geographically disadvantaged States.<sup>1319</sup>

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<sup>1310</sup> LOSC Article 62(1)

<sup>1311</sup> LOSC Article 62(2)

<sup>1312</sup> LOSC Article 62(3)-(5)

<sup>1313</sup> Churchill n18 p199

<sup>1314</sup> LOSC Articles 69(1)) and 70(1)

<sup>1315</sup> LOSC Article 160(2)

<sup>1316</sup> LOSC Article 69(3) and 70(4)

<sup>1317</sup> LOSC Article 254(1)

<sup>1318</sup> LOSC Article 254(1)

<sup>1319</sup> LOSC Articles 266(2) 269(a) 272 & 274(a)

## Traffic in Transit and the Means of Transport

### *Traffic in transit means*

*transit of persons, baggage, goods and means of transport across the territory of one or more transit States, when the passage across such territory, with or without transshipment, warehousing, breaking bulk or change in the mode of transport, is only a portion of a complete journey which begins or terminates within the territory of the landlocked State.*<sup>1320</sup>

### *Means of transport means*

- i) *railway rolling stock, sea, lake, and river craft and road vehicles;*
- ii) *where local conditions so require, porters and pack animals.*<sup>1321</sup>

Traffic in transit is not subject to customs and excise duties or taxes or other charges except those specifically related to the traffic<sup>1322</sup> and the traffic of a landlocked State must receive equal treatment in the ports.<sup>1323</sup>

A number of other requirements are that free zones and customs facilities<sup>1324</sup> and measures to avoid delays in the movement of the transit traffic may also be introduced.<sup>1325</sup> The means of transport used by the landlocked State is not to be levied charges greater than those normally imposed.<sup>1326</sup> Although landlocked States have the right of access to and from the sea through a transit State by all means of transport for the purpose of exercising its rights in terms of LOSC.<sup>1327</sup> It is submitted that what is not stressed is that the landlocked State and the transit State have to enter into bilateral agreements of the rights of the landlocked State.<sup>1328</sup> This requirement and the provision that states that a transit State is not prevented from exercising full sovereignty over its territory<sup>1329</sup> ensures that the transit State is not subjected to conditions that it finds untenable. In addition, where there are no, or inadequate, transit facilities in a transit State this State can look to the landlocked State for co-operation in the provision of these facilities.<sup>1330</sup>

Landlocked States enjoy the same rights of innocent passage through the territorial waters of coastal states even though they may not be a coastal State.<sup>1331</sup> This would be of little value to a landlocked State if were to be denied access to the ports of the coastal State.<sup>1332</sup> They are entitled to the freedom of the high seas to exercise all the activities listed in Article 87 and the right to sail vessels under its flag on the high seas.<sup>1333</sup>

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<sup>1320</sup> LOSC Article 124(1)(c)

<sup>1321</sup> LOSC Article 124 (1)

<sup>1322</sup> LOSC Article 127(1)

<sup>1323</sup> LOSC Article 131

<sup>1324</sup> LOSC Article 128

<sup>1325</sup> LOSC Article 130(2)

<sup>1326</sup> LOSC Article 127(2)

<sup>1327</sup> LOSC Article 125(1)

<sup>1328</sup> LOSC Article 125(2)

<sup>1329</sup> LOSC Article 125 (3)

<sup>1330</sup> LOSC Article 129

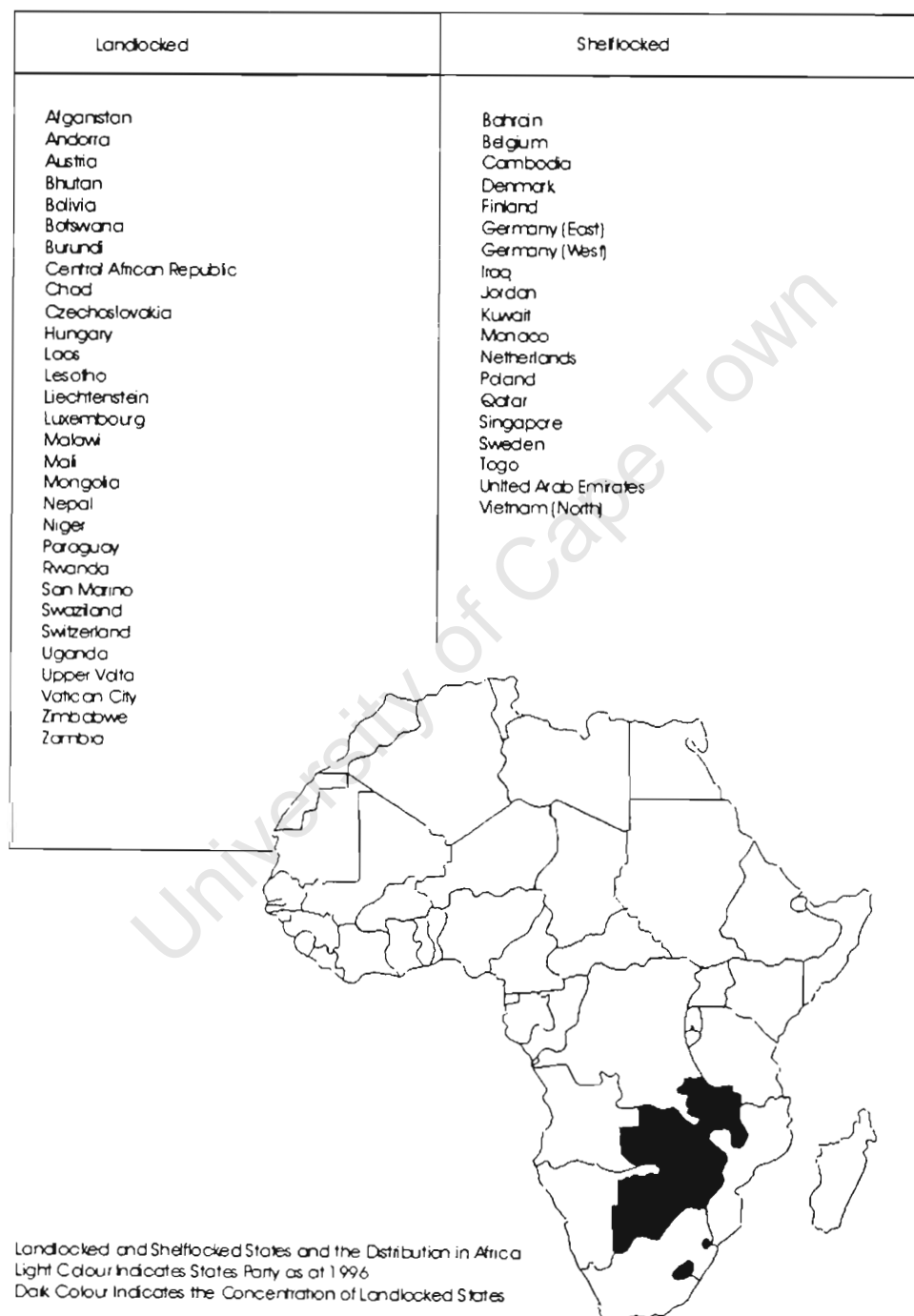
<sup>1331</sup> LOSC Article 17

<sup>1332</sup> Churchill n18 p280

<sup>1333</sup> LOSC Article 90

## Shelf-Locked States

This term is not used in LOSC but the term refers to those States that are geographically disadvantaged in regard to the extent of LOSC continental shelf they can claim. This is usually as a result of other States being between them and the high seas and whereas the sea between the States is subject to delimitation, claims to the sea areas open to the high seas are the sole prerogative of the outer State. Examples of this are Singapore which has Indonesia, Borneo and Malaysia between itself and the high seas and Sweden and Finland which have their coastlines, mainly, on the Gulf of Bothnia.



**Figure 77 LAND AND SHELF-LOCKED STATES**

### **Fishing Dispute Resolution**

The history of fishing disputes through the ages, discussed in Chapter I, must have led to the inclusion of Articles in LOSC which attempt to provide avenues for dispute settlement. In Part XV there are requirements for States involved in a dispute to resolve their problems by peaceful means.<sup>1334</sup> They are to move expeditiously to exchange views on possible negotiations.<sup>1335</sup> They are expected to take into consideration agreements or arrangements made previously, especially if they are extant.<sup>1336</sup> In accordance with the Convention, a Conciliation Commission may be set up, with 5 conciliators, from a list maintained by the Secretary General of the UN, to hear the dispute.<sup>1337</sup> If the dispute remains unresolved the parties are expected to proceed to the International Court of Justice or to a tribunal having the necessary jurisdiction.<sup>1338</sup>

There are however important exceptions to compulsory dispute settlement in Part XV. Some of these exceptions are relevant to disputes about resources in the exclusive economic zones (LOSC Article 297(3)(a)). There are no relevant scientific or technical issues involved in dispute settlement and the topic will not be further discussed.<sup>1339</sup>

### **ANTARCTIC RESOURCES**

Antarctica is unique in that it is a large continent over which no sovereignty is recognised although some territorial claims have been made. Its preservation is controlled by the Antarctic Treaty (1959)<sup>1340</sup> to which major States, involved in the region, are party. As Antarctica is not a sovereign State it is not possible to determine maritime zones.

#### **The Antarctic Region**

This region is normally considered to coincide with the area south of the Antarctic Convergence or Polar Front. This front occurs where the cold dense Antarctic water sinks beneath the less dense Subantarctic surface water. This usually occurs between 50 and 60 degrees south. In terms of the Antarctic Treaty the Antarctic Region commences at 60 degrees south and includes the area south of this latitude.<sup>1341</sup>

South Africa had shown little interest in laying claim to territory in Antarctica, unlike some other States. Many northern hemisphere States laid claim to territory or have established research bases on the continent. Antarctica adjoins the Southern Oceans and the Agulhas Current, which is a major factor on South Africa's east and south coast, turns south and becomes a substantial part of the Southern Ocean Current. This reverses the general flow of a large volume of water from a south-westerly direction to an easterly direction.

Although large distances are involved the resources in this region outside of South Africa's exclusive economic zone, are still of great interest to the RSA, other States with interests in the area and the international organisations constituted to protect these resources. It can be shown, in this Chapter, that the fish resources, that are part of South Africa's exclusive economic zone, could be an integral part of the south eastern Atlantic, south western Indian and the Southern Oceans.

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<sup>1334</sup> LOSC Article 279

<sup>1335</sup> LOSC Article 283

<sup>1336</sup> LOSC Article 282

<sup>1337</sup> LOSC Annex V

<sup>1338</sup> LOSC Articles 286 & 297(3)(a)

<sup>1339</sup> *ibid*

<sup>1340</sup> Antarctic Treaty: Final Report of the Fifteenth Antarctic Treaty Consultative Meeting- Paris (9-20 October 1989) p5-7

<sup>1341</sup> WR Siegfried "The Legal System Affecting Exploitation of Antarctic Natural Resources"  
Law of the Sea: Acta Juridica (1986) p61-68

The ice that is permanently over most of Antarctica, and in particular the coast, has an average thickness of 2 km,<sup>1342</sup> Normal surveys are impossible to undertake. In the case of bathymetric surveying special airborne bathymetric surveying techniques have been developed in Canada and Greenland to achieve the necessary charting of the permanently ice-covered coasts in those areas. These have not been undertaken to any significant degree in Antarctica. Very few charts are available and in some instances seismic profiles have been used to provide some evidence of the geographical and geological structures. The accuracy of these profiles is therefore suspect and the extent of the continental shelf of Antarctica is therefore not well known. It is possible to assume the limits of the land area and the provisions of the appropriate conventions can be applied there, but the extent of sub sea-surface Antarctic is not known.

The living resources of Antarctica and the Southern Ocean include krill, different species of fish, penguins, seals, squid and whales.<sup>1343</sup> In addition seaweed (kelp), petroleum oil and fresh water from icebergs are resources that are found in the area. Only krill, fish and whales have been harvested to date.<sup>1344</sup> To gauge by the number of animals that feed on the squid of the Southern Ocean it must be in abundant supply. This is a resource which is largely untapped, probably due to lack of expertise and equipment.<sup>1345</sup> It is considered likely that only krill can be economically harvested in this region for the foreseeable future.<sup>1346</sup> While the extent of the living resources are better known, little exploration has taken place in regard to non-living resources.<sup>1347</sup>

The Antarctic Treaty 1959 may be amended by States parties after 30 years have elapsed.<sup>1348</sup> This Treaty was followed by the Convention for the Conservation of Antarctic Seals 1978<sup>1349</sup> and the Convention on the Conservation of Antarctic Marine Living Resources (CCAMLR) 1982. Most of the harvesting of Antarctic fish is centred roughly around South Georgia in the South Atlantic and Kerguelen in the South Indian Ocean. Both of these islands are north of the boundary of the Antarctic Treaty Area. In accordance with the provisions of LOSC<sup>1350</sup> the coastal States, France and the United Kingdom, may extend their control for conservation purposes. This has not led to self-restraint by the operators that are catching the krill and fish.

Over-exploitation of the resource is a possibility.<sup>1351</sup> Articles IX and XV of CCAMLR impose obligations to carry out appropriate scientific research. This has not been carried out as joint projects. Each State has determined what it feels is the necessary research to be undertaken in its own and the CCAMLR's interests.<sup>1352</sup> This will produce research data of varying quality and quantity, with possible duplication, and will be dependent on the commitment, technical knowledge and resources of each State.<sup>1353</sup> In spite of this Siegfried feels that the CCAMLR has succeeded in pioneering some effective rules for the conservation of the resources and their eco-systems in the Antarctic Region.

### Marine Scientific Research

The term 'marine scientific research' is not defined in LOSC but can be accepted to mean any type of research survey or investigation undertaken in marine areas.

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<sup>1342</sup> *ibid*

<sup>1343</sup> *ibid* p62

<sup>1344</sup> *ibid*

<sup>1345</sup> *ibid* p63

<sup>1346</sup> *ibid* p66

<sup>1347</sup> *ibid*

<sup>1348</sup> Antarctic Treaty n1320 Article 6

<sup>1349</sup> Degenhardt n1263 p111

<sup>1350</sup> LOSC Article 117

<sup>1351</sup> Siegfried n1321 p67

<sup>1352</sup> *ibid*

<sup>1353</sup> *ibid*

Although all States irrespective of their geographical location have the right to conduct marine scientific research providing it is in accordance with the rights and duties of other States provided by LOSC. The conduct of marine scientific research may be divided into two categories:

- a) Research under the jurisdiction of the coastal State.
- b) Research under the jurisdiction of the Authority.

LOSC has a number of general provisions which apply;

- a) *marine scientific research shall be conducted exclusively for peaceful purposes;*
- b) *marine scientific research shall be conducted with appropriate scientific methods and means compatible with this Convention;*
- c) *marine scientific research shall not unjustifiably interfere with other legitimate uses of the sea compatible with this Convention and shall be duly respected in the course of such use;*
- d) *marine scientific research shall be conducted in compliance with all relevant regulations adopted in conformity with this Convention including those for the protection and preservation of the marine environment.*<sup>1354</sup>

It should be noted that “peaceful purposes” referred to in Article 240 (a) are to be read in accordance with the relevant Article of the UN Charter that interprets “peaceful purposes” as being non-aggressive or defensive purposes.<sup>1355</sup>

#### **Marine Scientific Research under the Jurisdiction of the Coastal State**

As a coastal State has sovereignty over its territorial waters this implies that it may conduct any form of marine scientific research provided it does not interfere with the right of innocent passage of vessels in those waters.<sup>1356</sup> Vessels in transit passage in straits enjoy similar status when marine scientific research is being conducted.<sup>1357</sup> Vessels in transit or exercising right of innocent passage may not, however engage in any form of marine scientific research or hydrographic activity without the permission of the coastal State.<sup>1358</sup>

In addition, in the exclusive economic zone and on the LOSC continental shelf, coastal States have sovereign rights for the purpose of exploring and exploiting conserving and managing the natural resources whether living or non-living and any related marine scientific research. The resources may be in the waters superjacent to the seabed, the seabed, or its subsoil as well as utilisation of the effects of wind, wave and current.<sup>1359</sup>

Coastal States are expected to consent to marine scientific research by other States and international organisations providing certain conditions are met. These include;

- a) the research is not related to the exploration or exploitation of the living or non-living resources in the region;

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<sup>1354</sup> LOSC Article 240

<sup>1355</sup> UN Charter n1023 Article 2 para 4

<sup>1356</sup> LOSC Articles 2 & 17

<sup>1357</sup> LOSC Article 38

<sup>1358</sup> LOSC Articles 19(2)(c)(j), 40

<sup>1359</sup> LOSC Article 59(1)(a) & (b)(ii)



- b) the research does not involve drilling on the continental shelf, the use of explosives, the use of harmful substances, the construction, operation or use of artificial islands, installations or structures;
- c) in accordance with LOSC information related to projects to be undertaken in an area have to be provided to the coastal State. This includes nature and objective of the project, the methods and means, including the names, tonnage, type and class of vessels and equipment to be used, the precise geographical area, the dates of first arrival or deployment of vessels or equipment and the final departure date, the sponsoring institute its director and person in charge's names and the extent to which the coastal State may participate in the project. If any of this information is inaccurate or not forthcoming or if there are any other outstanding it could be grounds to deny consent;
- d) the coastal State may designate specific areas where exploration will shortly commence and therefore decline consent
- e) the coastal State may also undertake projects with international organisations.<sup>1360</sup>

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<sup>1360</sup> LOSC Articles 245-248

## COMMENTED GLOSSARY OF TERMS RELEVANT TO RESOURCES USED IN LOSC

(Unless otherwise stated all definitions are taken from AJ Kerr, NR Guy et al IHO Manual on Technical Aspects of United Nations Convention on Law of the Sea 1982 3rd Ed 1993.)

### ACTIVITIES IN THE AREA

*'activities in the area' means all activities of exploration for, and exploitation of, the resources of the Area.* <sup>1361</sup>

#### Comment

The Area, is the sea-bed and ocean floor and subsoil thereof beyond the limits of national jurisdiction. It is under the control of the International Sea-Bed Authority, known as the ISBA or the Authority. The ISBA is responsible for the Area.

### ANADROMOUS STOCKS <sup>1362</sup>

*Fish that spend most of their lives in the ocean, but move up rivers to spawn.* <sup>1363</sup>

*Anadromous fish are spawned in the upper reaches of freshwater streams and, upon reaching a degree of maturity, begin their descent to the ocean.* <sup>1364</sup>

#### Comment

Large international fleets concentrate on the harvesting of this specie on the open-sea. The Japanese efforts in regard to oceanic salmon fishing is an example. <sup>1365</sup> The life cycle of the species is such therefore that the coastal State in which they spawn bears a large responsibility for ensuring the continuance of the specie.

### CATADROMOUS SPECIES <sup>1366</sup>

*Fish that live in fresh water and migrate to salt water to breed.* <sup>1367</sup>

#### Comment

The species migrates through the waters of a coastal State and the State is obligated in accordance with LOSC to protect this process. These fish may not be fished on the high seas.

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<sup>1361</sup> LOSC Article 1(1)(3)

<sup>1362</sup> LOSC Article 66

<sup>1363</sup> Tietjen n1175 p10

<sup>1364</sup> Brittin n945 p135

<sup>1365</sup> ibid

<sup>1366</sup> LOSC Article 67

<sup>1367</sup> Tietjen n1175 p45

## CATCH

**Allowable Catch** <sup>1368</sup> (**Harvesting Capacity**, <sup>1369</sup> **Maximum Sustainable Yield**, <sup>1370</sup> **Quotas**, <sup>1371</sup> **Stocks**, <sup>1372</sup> **Surplus**, <sup>1373</sup>)

*The coastal State, taking into account the best scientific evidence available to it, shall ensure through proper conservation and management measures that the maintenance of the living resources in the exclusive economic zone is not endangered by over-exploitation.* <sup>1374</sup>

### Comment

An allowable catch is determined by a coastal State to ensure that the maximum sustainable yield is harvested. This is inter-related with the harvesting capacity of the coastal State and the latest determined stocks of the species. This in turn determines any surplus that may exist and the quotas that may be awarded to harvest any species. <sup>1375</sup>

## CETACEANS <sup>1376</sup>

*The order of aquatic mammals that includes the whales and porpoises or dolphins. In general, this order is characterised by a broad tail, tiny ears, and hairlessness, Cetaceans live in practically every marine environment.*

### Comment

Cetaceans are regarded as being a highly migratory species. <sup>1377</sup> Their exploitation is subject to monitoring by a number of international organisations formed to preserve and protect them, such as the International Whaling Commission. LOSC is not in conflict with the intent of these organisations and coastal States are expected to co-operate in the protection of the species. Some coastal States have prohibited whaling within their exclusive economic zones, for example, Australia, the United Kingdom and the United States. <sup>1378</sup>

## ECOSYSTEMS <sup>1379</sup>

*A term used to describe the interrelationships between all organisms in a given area, and their relationships to the non-living materials that make life possible.* <sup>1380</sup>

### Comment

The ocean is divided into a series of environmental zones. All aquatic life is dependent on the inorganic or non-living materials present in the oceans. An ecosystem comprises three arbitrary types, planktonic, nektonic, and benthic. Plankton can be either zooplankton (animal like) or phytoplankton (plantlike). Nekton comprises swimming organisms including fish, cetaceans, crustaceans, squid and octopus. Benthic organisms are bottom dwellers such as grasses, algae, crabs, lobsters, oysters, sea-anemone, echinoderms and corals. <sup>1381</sup>

<sup>1368</sup> LOSC Articles 61(1), 62(2) & (4)(b), 66(2), 69(3), 70(4), 119(1), 297(3)(a) & (3)(b)(ii)

<sup>1369</sup> LOSC Articles 69(3), 70(4), 297(3)(a) & (b)(ii)

<sup>1370</sup> LOSC Article 61(3), 119(1)(a)

<sup>1371</sup> LOSC Article 62(4)(b)

<sup>1372</sup> LOSC Articles 61(3) & (5), 62(3), 63, 66(4), 119(1)(a) & (2), 297(3)(b)(ii)

<sup>1373</sup> LOSC Articles 62(2) & (3), 69(1), 70(1), 297(3)(a) & (b)(iii)

<sup>1374</sup> LOSC Article 61(2)

<sup>1375</sup> LOSC Article 62

<sup>1376</sup> LOSC Annex 1, and Article 65, Tietjen n1175 p47

<sup>1377</sup> ibid

<sup>1378</sup> Churchill n18 p208

<sup>1379</sup> LOSC Articles 194(5), 195

<sup>1380</sup> Tietjen n1175 p88

<sup>1381</sup> ibid

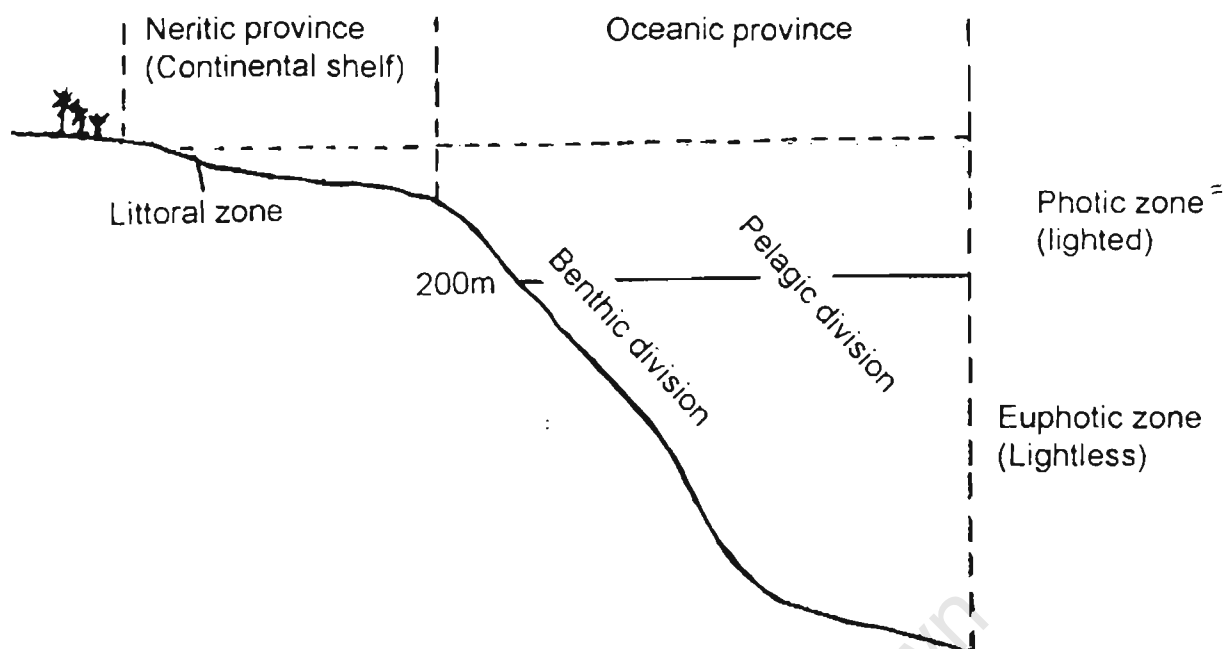


Figure 78 OCEANIC SYSTEMS

**ENTERPRISE** <sup>1382</sup> (Transportation, Processing and Marketing of Minerals.) <sup>1383</sup>

*The Enterprise shall be the organ of the Authority which shall carry out activities in the Area directly, pursuant article 153 paragraph 2(a) as well as in the transporting, processing and marketing of minerals recovered from the Area.* <sup>1384</sup>

**Comment**

The Enterprise is the commercial organ of the authority and it is responsible for any exploitation of the Area that may be undertaken by the Authority.

**GEAR** <sup>1385</sup>

No specific definition of fishing gear is given in LOSC, but LOSC Article 62(4)(c) contains provision for the coastal State to regulate, by legislation, the types, sizes and amount of gear and fishing vessels that may operate within their jurisdiction.

**Comment**

Inshore fisherman rarely fish beyond 3-5 nm from the coast but this is dependent on the weather and environmental conditions of the coastal State. Rods, handlines and small nets are the usual means of fishing for mobile fish. Traps, pots and diving methods are used for the sedentary species. Small vessels are employed and there is usually no refrigeration facility aboard. This restricts these vessels to within easy range of a market. Larger refrigerated vessels operate off the coast or as fish processing factory world-wide. These vessels use trawls such as otter trawls, purse seine and gillnets. <sup>1386</sup>

<sup>1382</sup> LOSC Articles 144(2), 150(d), 151(1)(c), 153(2)(a), 158(2) & (4), 160(2)(f)(ii), (g) & (i), 162(2)(c), (k), (i) & (x), 165(2)(l), 168(2), 170(1)-(4), 171(c), 173(2)(b), 177, 187(c), 273, A3/, A4/ & R/2

<sup>1383</sup> LOSC Article 170(1), A4/1(1)

<sup>1384</sup> LOSC Article 170(1)

<sup>1385</sup> LOSC Articles 42(1)(c), 62(4)(c) & 115

<sup>1386</sup> Tietjen n1175 p108.

## HIGH SEAS <sup>1387</sup>

*...all parts of the sea that are not included in the exclusive economic zone, in the territorial sea or in the internal waters of a State, or in the archipelagic waters of an archipelagic State.* <sup>1388</sup>

### Comment

While the high seas begin where national jurisdiction ceases, the extent of national jurisdiction is determined by international acceptance.

## HIGHLY MIGRATORY <sup>1389</sup>

*A term used to describe regular animal journeys along well-defined routes, particularly those involving a return to breeding grounds.* <sup>1390</sup>

### Comment

Anadromous, catadromous and cetacean species, and oceanodromous fish, which spend their entire life in the oceans such as herrings, are categorised as being highly migratory. This means that the conservation of these resources can only be achieved by international co-operation. <sup>1391</sup> LOSC is intended to give the widest possible authority, support and encouragement to the States Party to achieve this. <sup>1392</sup>

## LIVING (Fishing, Marine Life) <sup>1393</sup>

Not defined in LOSC.

### Comment

While this term is not defined in LOSC all living organisms found at any stage within the exclusive economic zone of a coastal State are the property of the State. These organisms can be migratory or sedentary. <sup>1394</sup>

## INSTALLATIONS (Platforms, Structures) <sup>1395</sup>

*Man-made Structure, such as installations, platforms and structures, in the territorial sea, exclusive economic zone or on the continental shelf usually for the exploration or exploitation of marine resources. They may also be built for other purposes such as marine scientific research, tide observations etc.* <sup>1396</sup>

### Comment

Artificial islands, platforms or structures may be erected for the reasons stated above but during the erection or removal the coastal State is obligated to ensure that safety of navigation is ensured and undue inconvenience to navigators should be avoided. <sup>1397</sup>

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<sup>1387</sup> LOSC Articles 116-120

<sup>1388</sup> LOSC Article 86

<sup>1389</sup> LOSC Annex 1, Articles 64, 65 & 120

<sup>1390</sup> Tietjen n1175 p177

<sup>1391</sup> *ibid*

<sup>1392</sup> LOSC Parts XII & XIII

<sup>1393</sup> LOSC Preamble 4, LOSC Articles 19(2)(i), 21(1)(d) & (e), 42(1)(c), 51(1), 59(1)(a), 60(3), 61-73, 87(1)(e), 115-120, 123(a), 147(2)(b), 194(5), 221(1), 277(a), 297(3)(a), (b)(i) & (ii)

<sup>1394</sup> LOSC Article 59(1)(a)

<sup>1395</sup> LOSC Articles 1(1)(5), (a) & (b)(i), 19(2)(k), 21(1)(b), 59(1)(b)(i), 60(3)-(8), 79(4), 80, 87(1)(d), 94(7), 111(2), 145(a), 147(2)(a)-(e), 153(5), 180, 194(3)(c) & (d), 208(1), 209(2), 214, 246(5)(c), 249(1)(a) & (g), 258-262

<sup>1396</sup> IHO n192 p17

<sup>1397</sup> LOSC Article 60(3)

## INTERGOVERNMENTAL OCEANOGRAPHIC COMMISSION (IOC) <sup>1398</sup>

### Comment

The IOC is a division of UNESCO and has its headquarters in Paris. It is the international organisation responsible for monitoring oceanographic matters and the preparation of conventions that will give effect to the requirements of the international community in this regard. <sup>1399</sup>

### LANDLOCKED STATES (Geographically Disadvantaged States)

*Landlocked States means a State which has no sea-coast.* <sup>1400</sup>

*geographically disadvantaged States means coastal States, including States bordering on enclosed or semi-enclosed seas, whose geographical situation makes them dependent upon the exploitation of the living resources of the exclusive economic zones of other States in the subregion or region for adequate supplies of fish for the nutritional purposes of their populations or parts thereof, and coastal States which can claim no exclusive economic zones of their own.* <sup>1401</sup>

### Comment

The rights of landlocked States over coastal States that are considered transit States could impact significantly on the coastal State. The main impact would be in the field of fishing and security. A landlocked State may participate in the surplus fish resources of a coastal State and the levels of maximum yield, while they are determined by the coastal State, could be subject to international confirmation. If a landlocked State is able to participate in fishing in a exclusive economic zone the presence of foreign vessels off a States coast, that are not exercising freedom of navigation, could result in security concerns for the coastal State. <sup>1402</sup>

### MARINE MAMMALS <sup>1403</sup>

*An air-breathing endothermic (warm-blooded) animal whose young are born alive and fed on milk.* <sup>1404</sup>

### Comment

Due to the efforts of international organisations to preserve and protect these animals LOSC has not introduced many Articles dealing with marine mammals, but LOSC Article 65 encourages coastal States and international organisations to prohibit, limit or regulate the exploitation of marine mammals more strictly than provided for in LOSC.

### MINERALS

#### Cobalt <sup>1405</sup>

*A hard, silver-white magnetic metal present, in solution, in seawater in much lower concentration than in continental rock.* <sup>1406</sup>

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<sup>1398</sup> LOSC A2/3(2)

<sup>1399</sup> LOSC Article 59(1)(a)

<sup>1400</sup> LOSC Article 124(1)(a)

<sup>1401</sup> LOSC Article 70(2)

<sup>1402</sup> Degenhardt n1263 p4, LB Sohn "International Law of the Sea and Human Rights" The Law of the Sea: What Lies Ahead? Proceedings of the 20<sup>th</sup> Annual Conference of the Law of the Sea Institute (1986) p4

<sup>1403</sup> LOSC Articles 65, 120

<sup>1404</sup> Tietjen n1175 p166

<sup>1405</sup> LOSC Articles 151(7), A3/13(6)(e), A4/11(3)(a), RF2/1(d)

<sup>1406</sup> Tietjen n1175 p56

### Comment

Cobalt is found in deep-sea sediment and in the ferro-manganese micronodules found on the seafloor. It could have resulted from precipitation from seawater or as a result of volcanic activity.<sup>1407</sup>

### Copper<sup>1408</sup>

*A moderately hard metal of a reddish colour.*<sup>1409</sup>

### Comment

Copper is an essential micronutrient in living systems. It is an element in the blood of some crustaceans and giant kelp is a species that requires copper if reasonable quantities exist.<sup>1410</sup>

### Nickel<sup>1411</sup>

*A relatively rare, silvery-white metallic element with commercial importance in alloys and as a catalyst.*<sup>1412</sup>

### Comment

Nickel is found dissolved in sea-water and as a component of the polymetallic nodules of the order of about 2%.<sup>1413</sup>

### Polymetallic (Manganese) Nodules<sup>1414</sup>

*Nodules found on the ocean floor, in which manganese is the dominant element.*<sup>1415</sup>

### Comment

The nodules are widely distributed over the deep ocean floor and contain at least 26 other elements. They are often approximately 3 cm in diameter and could have resulted from precipitation in the sea-water and from interstitial water of the seas.<sup>1416</sup>

### MINING CONTRIBUTIONS<sup>1417</sup>

*The coastal State shall make payments or contributions in kind in respect of exploitation of the non-living resources of the continental shelf beyond 200 nautical miles from the baselines from which the territorial sea is measured.*<sup>1418</sup>

*Within a year of the date of commencement of the commercial production, in conformity with paragraph 3, a contractor shall choose to make his financial contribution to the Authority by either;*

- a) paying a production charge only; or;*
- b) paying a combination of a production charge and a share of the net proceeds.*<sup>1419</sup>

<sup>1407</sup> ibid

<sup>1408</sup> LOSC Articles 151(7), A3/13(6)(e), A4/11(3)(a), R2/1(d)

<sup>1409</sup> AH Poole (ed) New Imperial Dictionary p232

<sup>1410</sup> Tietjen n1175 p63

<sup>1411</sup> LOSC Article 15

<sup>1412</sup> Tietjen n1175 p1901

<sup>1413</sup> ibid p166

<sup>1414</sup> LOSC Articles 133(a), 151 (6)(a) &(7), 162(2)(o)(ii), A3/6(3), A3/8, A3/13(5)(a), A3/13(6), A3/13(7)(b) &(8), R2/(1)(b) &(d), R2(3)(a)

<sup>1415</sup> ibid p166

<sup>1416</sup> ibid

<sup>1417</sup> LOSC Articles 82, 160(2)(e)&(f)(i), 162(2)(o)(i), 171(a), &(e) 173(1)&(2), 184, A4/11(1)(b) &(3)(d)

<sup>1418</sup> LOSC Article 82(1)

<sup>1419</sup> LOSC A3/13(4)

## Comment

The exploration, exploitation and conservation of the resources within the exclusive economic zone are exclusively those of the coastal State. After the first five years of production of the resources on the continental shelf of the State beyond the exclusive economic zone a contribution of 1% of the total value of the production shall be paid to the Authority. This rate will increase by 1% per annum until a maximum of 7% is reached. The contribution is assessed from the value of the metals processed from the mining operation.<sup>1420</sup>

## NATURAL RESOURCES<sup>1421</sup>

*Natural resources referred to in LOSC are the mineral, other non-living resources and the living organisms of the sea, sea-bed, and the subsoil. The extent to which a coastal State may lay claim to these resources is dependant on the maritime zone in which they are found.*

## OCEAN FLOOR<sup>1422</sup> (Sea-bed)

*The top of the surface layer of sand, rock, mud or other material lying at the bottom of the sea and immediately above the subsoil.*<sup>1423</sup>

## Comment

The ocean floor commences at the low-water line and is also referred to as the sea-bed.

## OCEANOGRAPHY<sup>1424</sup>

*The study of the sea, embracing and integrating all knowledge pertaining to the sea's physical boundaries, the chemistry and physics of sea water, marine biology, and submarine geology.*<sup>1425</sup>

## OCEANOLOGY<sup>1426</sup>

*See OCEANOGRAPHY.*<sup>1427</sup>

## OFFSHORE<sup>1428</sup>

*Away from the shore,<sup>1429</sup> normally extending seawards to the shelf break.*

## Comment

Any area of the ocean that is seaward of the low water line could be regarded as being offshore. A division between oceanic and offshore is usually adopted with the division being at the edge of the geological continental shelf.

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<sup>1420</sup> LOSC A3/13 (4) &(5)

<sup>1421</sup> LOSC Articles 77, 79(2), 133, 193, R2/1(f)

<sup>1422</sup> LOSC Preamble 6 1(1')(1), 76(3)

<sup>1423</sup> IHO n192 p23

<sup>1424</sup> LOSC Article 277(a)

<sup>1425</sup> IHO Dictionary n353 p161

<sup>1426</sup> LOSC Article 165(1)

<sup>1427</sup> IHO Dictionary n353 p161

<sup>1428</sup> LOSC Articles 211(3), 216(1)(c), 218(1) &(3), 219, 220(1)

<sup>1429</sup> IHO Dictionary n353 p162



## PLAN OF WORK (AREA) <sup>1430</sup>

*Proposed plans of work shall comply with and be governed by the relevant provisions of this Convention and the rules, regulations and procedures of the Authority, including those on operational requirements, financial contributions and the undertakings concerning the transfer of technology.* <sup>1431</sup>

### Comment

Six months after LOSC came into force, had the Authority been elected and in place plans of work could have been considered. These plans are for exploration and possibly exploitation of non-living resources of the sea-bed beyond the claims of coastal States.

## PROCESSED METALS <sup>1432</sup>

*Processed metals ...means the metals in the most basic form in which they are customarily traded on international terminal markets.* <sup>1433</sup>

### Comment

Processed metals are the product that the contractor would normally sell on a market and it is the value of this product that will determine the contribution that will be paid to the Authority. <sup>1434</sup>

## PRODUCTION POLICIES (Authorisations, Ceilings, Charges) <sup>1435</sup>

*Activities in the Area shall, as specifically provided for in this Part, be carried out in such a manner as to foster healthy development of the world economy and balanced growth of international trade, and to promote international co-operation for the over-all development of all countries, especially developing States,..* <sup>1436</sup>

### Comment

Part XI, and the Agreement on the implementation of Part XI, govern all aspects of the exploration and exploitation of the resources of the Area. This includes production policies, production ceilings, authorisations and the charges levied.

## SAMPLING <sup>1437</sup>

*The laws and regulations ...may relate, inter alia, to...the conduct of specified fisheries research programmes and regulating the conduct of such research, including the sampling of catches, disposition of samples and reporting associated scientific data.* <sup>1438</sup>

*Without prejudice to the powers of the Authority pursuant to Article 17 of this Annex, the data to be submitted concerning polymetallic nodules, shall relate to mapping, sampling, the abundance of nodules, and their metal content.* <sup>1439</sup>

<sup>1430</sup> LOSC Article 151(2)(a)(b)(e), (3) & (6)(b), 153(3), 155(1), 162(2)(j), 187(c)(i), A3/3(4) & (5), A3/5(1) & (3)(1), A3/6(2) & (3)(a)-(c) & (4), A3/8, A3(9)(4), A3/10, A3/12(2), A3/13(2), A3/14, A3/16, A3/17(2)(b)-(e), A3/20, A4/129(1) & (2), R2/7(c), R2/8

<sup>1431</sup> LOSC A3/6 (3)

<sup>1432</sup> LOSC A3/13(7)(a)

<sup>1433</sup> *ibid*

<sup>1434</sup> *ibid*

<sup>1435</sup> LOSC Articles 151, A3/7(4) & (6), A3/13(3),(4),(5), & (6) A4/6(e), R2/9

<sup>1436</sup> LOSC Article 150

<sup>1437</sup> LOSC Article 62(4)(f), A3/8

<sup>1438</sup> LOSC Article 62(7)(f)

<sup>1439</sup> LOSC A3/8

### Comment

In the same way that the coastal State is entitled to monitor, and to sample, fishing in its exclusive economic zone, the Authority requires contractors to submit comprehensive plans prior to approval to mine, and constant updates in regard to progress. Included in this is sampling.

### SEDENTARY<sup>1440</sup>

*...organisms which, at the harvestable stage, either are immobile on or under the seabed or are unable to move except in constant physical contact with the seabed or the subsoil.*<sup>1441</sup>

### Comment

Sedentary species, within an exclusive economic zone are an exclusive resource of the coastal State. Sedentary species found on the continental shelf of the coastal are similarly an exclusive resource and;

*...the coastal State is under no obligation to take any management or conservation measures, nor to accommodate foreign fisherman.*<sup>1442</sup>

### SIZE OF AREAS (Exploration and Exploitation)<sup>1443</sup>

*The Authority shall determine the appropriate size of areas for exploration, which may be up to twice as large as those for exploitation in order to permit intensive exploration operations.*<sup>1444</sup>

### Comment

The requirements for a submission to obtain permission to explore an area are laid down in LOSC and provide for exploration of areas that could sustain two commercially viable mining operations.<sup>1445</sup>

### SPECIES<sup>1446</sup>

Not defined in LOSC but general usage defines a species as;

*individuals having common characteristics, specialised from others of the same 'genus'.*<sup>1447</sup>

### Comment

Species is only used in reference to living organisms and LOSC lists various species for separate or special treatment by both the coastal and other States.

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<sup>1440</sup> LOSC Articles 68

<sup>1441</sup> LOSC Article 77(4)

<sup>1442</sup> Churchill n18 p208, LOSC Article 68

<sup>1443</sup> LOSC A3/8, A3/17(2)(a)

<sup>1444</sup> LOSC A3/(17)(2)(a)

<sup>1445</sup> LOSC A/3(8)

<sup>1446</sup> LOSC Articles 61(1)(3) &(4), 62(4)(b) &(d), 63, 67(2) &(3), 119(1), 194(5)

<sup>1447</sup> Dictionary n11175 p1059

## FUNCTIONAL APPLICATIONS IN LOSC

## CHAPTER XI

## POLLUTION

## INTRODUCTION

The sea is being used, to an ever greater extent, in its historic role as an avenue for world transportation. This carries with the ever increasing threat of pollution as well. Pollution is the major peacetime marine hazard. It can take the form of oil pollution from a maritime casualty, pollution from land based sources, pollution from nuclear or noxious waste disposal or transportation, or the dumping of material damaging to the environment. Coastal States have, for centuries, used the seas and oceans for the disposal of wastes. Very little thought was given to the possibility that the oceans were incapable of accommodating the waste or that it would have an effect on the resources of the oceans. This was first addressed during the 1954 conference that gave rise to the London Convention for the Prevention of Oil Pollution of the Seas. While this was a start the fact that only the Flag State had jurisdiction over a vessel that was responsible for acts of pollution was regarded internationally as being inadequate. Many of the disappointed States took unilateral action, such as the United States which passed stricter legislation concerning its own ships and the dumping of pollutants in the seas. The major event to change the thinking on coastal State involvement in the control of pollution resulted from the devastating effects of the grounding, in 1967, of the supertanker, the 118 000 ton *Torrey Canyon*, on the Seven Stones Reef off Lands End on the south western coast of the United Kingdom.<sup>1448</sup>

The Intergovernmental Maritime Consultative Organisation (IMCO) convened a conference in 1969 which resulted in the Convention on Intervention. Two Articles reflect the concern of the conference over the *Torrey Canyon* incident.

*[the coastal State may] take such measures on the high seas as may be necessary to prevent, mitigate, or eliminate grave and imminent danger to their coastline or related interests from pollution or threat of pollution of the sea by oil, following upon a maritime casualty.*<sup>1449</sup>

*In cases of extreme urgency requiring measures to be taken immediately, the coastal State may take measures rendered necessary by the urgency of the situation, without prior notification or consultation with the Flag State.*<sup>1450</sup>

These Articles were a major step in favour of coastal States interests over the traditional right of freedom of navigation. This Convention also resulted in the LOSC Conference taking greater notice of the problems of the coastal State in the event of a maritime disaster. During the course of the Conference a further two disasters gave emphasise to the problem. These were the *Argo Merchant* and *Amoco Cadiz* disasters which occurred in 1976 and 1978.<sup>1451</sup>

The *Amoco Cadiz* was a Liberian supertanker that drifted off the coast of Brittany discharging 210 000 tons of crude oil into the sea.<sup>1452</sup> Coupled with two oil field blowouts in the North Sea and on the

<sup>1448</sup> Brittin n945 p142 and Churchill n18 p212

<sup>1449</sup> LOSC Article I(1)

<sup>1450</sup> LOSC Article III (d)

<sup>1451</sup> Brittin n945 p142

<sup>1452</sup> Churchill n18 p212

Mexican continental shelf where 30 000 and over 400 000 tons of oil were discharged it highlighted the urgency of the situation in the 1970's.

## POLLUTION AND DUMPING

*pollution means the introduction by man, directly or indirectly, of substances or energy into the marine environment (including estuaries) resulting in such deleterious effects as harmful to living resources, hazards to human health, hindrance to marine activities including fishing, impairment of quality for use of sea water and reduction of amenities.*<sup>1453</sup>

The 1958 Geneva Conventions provide for States Party to co-operate in the protection of the living resources of the high seas. While a coastal State may enforce its national legislation to achieve this in its maritime zones, up to 1958 little had been done to protect the high seas.<sup>1454</sup>

Excluding bi-lateral, or inter-State agreements, between 1954 and 1982 eighteen conventions have come into force. Some are directly related to pollution and others, while they may deal with standards in other disciplines such as vessels and the qualifications of sea-going personnel, are indirectly related to the control of pollution.<sup>1455</sup>

It has been internationally recognised that lack of control over activities on or near the sea and the careless transportation of some cargoes could result in serious consequences for coastal States. Little is found in customary law to prohibit or control these activities or the transportation of these substances.<sup>1456</sup>

### Sources of Marine Pollution

Donaldson lists five main sources of pollution and the Royal Commission lists seven, but the four listed in Churchill cover all possibilities.

These four main sources of marine pollution are as follows;

- a) land based activities,
- b) dumping,

<sup>1453</sup> IMO/FAO/UNESCO/WHO/IAEA/UNUNEP Joint Group of Experts on the Scientific Aspects of Marine Pollution (GESAMP) Rep Stud 7

<sup>1454</sup> Convention on the High Seas n26, LOSC Article (2)

<sup>1455</sup> 1954 (Amended 1962, 1969, 1971) London Convention for the Prevention of Pollution of the Sea by Oil. (OILPOL), 1957 Brussels International Convention Relating to the Limitation of the Liability of Owners of Sea-Going Ships, 1962 Brussels Convention of Operators of Nuclear Ships, 1963 Vienna Convention on Civil Liability for Nuclear Damage, 1969 Brussels Convention Relating to Intervention on the High Seas in Cases of Oil Pollution Casualties, 1969 Brussels International Convention on Civil Liability for Oil Pollution Damage. (CLC), 1969 Bonn Agreement for Co-operation in Dealing with Pollution of the North Sea by Oil, 1971 Brussels International Convention on the Establishment of an International Fund for Compensation for Oil Pollution Damage. (Fund Convention) When this convention came into force in 1978 the International Oil Pollution Compensation Fund (IOPC Fund) was established by as an inter-governmental organisation. The purpose of the IOPC is to administer the regime of compensation established by the Fund Convention, 1972 Oslo Convention for the Prevention of Marine Pollution by Dumping from Ships and Aircraft, 1972 London Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, 1972 London Convention on the International Regulations for Preventing Collisions at Sea, 1973 London International Convention for the Prevention of Pollution from Ships. (MARPOL), 1973 London Protocol relating to Intervention on the High Seas in Cases of Marine Pollution by Substances other than Oil, 1976 Barcelona Convention for the Protection of the Mediterranean Sea against Pollution and the Protocols for the Prevention of Pollution of the Mediterranean Sea by Dumping from Ships and Aircraft and concerning Co-operation in Combating Pollution of the Mediterranean Sea by Oil and other Harmful Substances in Cases of Emergency, 1977 London International Convention on Civil Liability for Oil Pollution Damage resulting from the Exploration for, or Exploitation of, Submarine Resources, 1979 Geneva Convention on Long-Range Transboundary Air Pollution, 1981 Abidjan Convention for Co-operation in the Protection and Development of the Marine and Coastal Environment of the West and Central African Region and a Protocol concerning Co-operation in Combating Pollution in Cases of Emergency, 1982 Jeddah Regional Convention for the Conservation of the Red Sea and Gulf of Aden Environment and a Protocol concerning Regional Co-operation in Combating Pollution by Oil and other Harmful Substances in Cases of Emergency.

<sup>1456</sup> Churchill n18 p216

c) sea-bed activities and

d) shipping<sup>1457</sup>

LOSC defines pollution of the marine environment and dumping as follows;

*pollution of the marine environment means the introduction by man, directly or indirectly, of substances or energy into the marine environment, including estuaries, which result or is likely to result in such deleterious effects as harm to living resources and marine life, hazards to human health, hindrance to marine activities, including fishing and other legitimate uses of the sea, impairment of quality for use of sea water and reduction of amenities.*<sup>1458</sup>

This definition is slightly different to the definition adopted by GESAMP ( page 288) and while it does not substantially change the intent of Article 1(4) the one significant omission in the GESAMP definition is 'other legitimate uses of the sea'. It is not clear why this phrase should have been omitted.

*dumping means;*

a) *any deliberate disposal of wastes or other matter from vessels, aircraft, platforms or other man-made structures at sea;*

b) *any deliberate disposal of vessels, aircraft, platforms or other man-made structures at sea.*<sup>1459</sup>

LOSC precludes from this definition the following;

a) *the discharge of wastes and matter incidental to the normal operation of vessels and the other instances mentioned in the definition which does not include material of this nature that is transported to the vessels or by them for the purpose of disposal. This includes material that is treated.*

b) *the placement, but not disposal of, matter that is not contrary to LOSC.*<sup>1460</sup>

In accordance with LOSC States Parties are obligated to take all measures necessary, individually or jointly, to prevent, reduce or control pollution of the marine environment.<sup>1461</sup> This includes all activities under their jurisdiction and includes the following threats and effects of pollution from maritime sources, land-based sources, through the air and from dumping;

a) *the release of toxic, harmful or noxious waste,*

b) *pollution from vessels, deliberately or as a result of accidents and collisions,*

c) *pollution from installations, structures and devices used for exploration or exploitation,*

d) *pollution from any other installation, structure or device capable of polluting the marine environment.*<sup>1462</sup>

### Types of Pollution

Some of the main pollutants are as follows;

a) pollutants that are biodegradable such as oil and oil products.

Oil and oil products, while they are eventually biodegradable create enormous damage to marine and birdlife. Fish can subsequently suffer from disease and shellfish can become inedible and toxic.<sup>1463</sup> A 1982 report on degradable wastes states the following however;

<sup>1457</sup> ibid p213. Starke n751 p403

<sup>1458</sup> LOSC Article 1 (4)

<sup>1459</sup> LOSC Article 1 (5)(a)

<sup>1460</sup> LOSC Article 1(1)(5)(b)

<sup>1461</sup> LOSC Article 194 (1)

<sup>1462</sup> LOSC Article 194 (3)(a)-(d)

<sup>1463</sup> ibid

*to the surprise of some, it was found that the marine environment eventually recovers from even the most serious oil pollution incidents. It is, however, recognised that oil pollution does give rise to short-term physical damage to our coasts and to marine life whose immediate consequences are potentially serious.*<sup>1464</sup>

b) Those pollutants that are partially biodegradable such as raw sewage.<sup>1465</sup>

Raw sewage is capable of being biodegraded but only in limited amounts. If large amounts of sewage are allowed to enter the water in an area this could result in overfertilisation, decomposition and de-oxygenation of the water. This would cause a depletion of fish and other marine life and could result in the total depletion of the living resources in the area..<sup>1466</sup>

c) Those pollutants that are not biodegradable such as radioactive waste, chlorinated hydrocarbons(DDT etc), polychlorinated biphenyl (PCB's) and heavy metals such as lead, mercury and cadmium.<sup>1467</sup>

Pollutants that are not biodegradable in any form no matter how long they are left result in the accumulation of deposits in fish and shellfish that eventually work their way up the food-chain, polluting the entire living resource.<sup>1468</sup> Mercury that has been discharged into the ocean contributes to the accumulation of methyl mercury in marine life. It is then transferred to those who eat the marine life.<sup>1469</sup> As dilution and dispersion are not solutions to this problem, preventative measures have to be taken to ensure that these pollutants do not enter the water.<sup>1470</sup> If this is not successful it is possible that the total extinction of some species of fish, shellfish, marine mammals and fragile ecosystems and even climatic changes could occur.<sup>1471</sup>

The Articles of LOSC place the responsibility for the protection of the environment in a coastal States zones on that State and these responsibilities will be considered first. Pollution is defined in Article 1(1)(4) (page 307) is so all embracing that it makes it impossible for any activity to take place ashore or at sea that threatens the environment not to fall within it.

A similar definition in Article 1 (1)(5) of dumping makes it a most comprehensive definition as well. LOSC contains Articles for the prevention and reduction of pollution from the following sources.

### Land-Based Pollution

Land-based sources are by far the most important source of marine pollution accounting for approximately 60% of the total.<sup>1472</sup> Rivers usually enter the sea and are the main transporters of land based pollution although some pollutants enter the sea directly off the land.<sup>1473</sup> Sewage, industrial waste, pesticides and chemicals used in agriculture, forestry and public health amenities as well as fertilisers end up in rivers which in turn deposit the foreign matter in the coastal zone.<sup>1474</sup>

Much of the sewage that is discharged into the sea is harmless providing it is naturally biodegradable and does not contain harmful poisons such as some metals and biocides. The amount of sewage that can safely be dumped is however not limitless as it is dependant on the area of water into which it is released, and the configuration of the coast and the sea-bed.

<sup>1464</sup> LH van Meurs "Marine Pollution" Institute of Marine Law Pub No2 (1986) p5 & 112

<sup>1465</sup> Seibold n357 p299

<sup>1466</sup> Churchill n18 p215

<sup>1467</sup> *ibid.* van Meurs n1444 p5

<sup>1468</sup> Churchill n18 p215

<sup>1469</sup> van Meurs n1444 p5

<sup>1470</sup> *ibid*

<sup>1471</sup> *ibid* p6

<sup>1472</sup> Eighth Report of the Royal Commission on Environmental Pollution London (October 1981) p13

<sup>1473</sup> Churchill n18 p214

<sup>1474</sup> Royal Commission n1452 p12

As there are complicated eco-systems in seas and oceans the effect of poor disposal management could damage these systems to points from which it would take decades to recover naturally. Uncontrolled dumping of municipal sludge, 8-9 million wet tons per annum, in moderately deep water approximately 180 nm off New Jersey between 1986 and 1992 resulted in damage to the benthic food web to depths of 2500 metres.<sup>1475</sup>

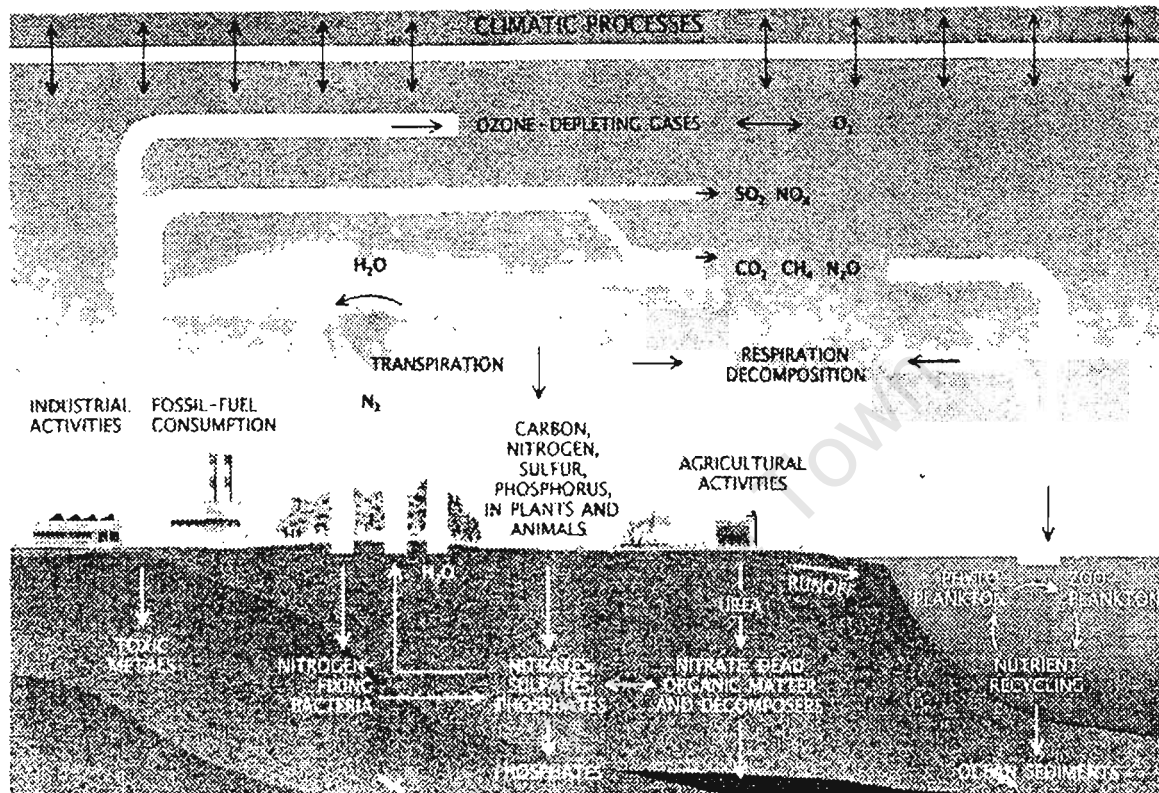


Figure 79 LAND BASED POLLUTION CYCLE

In enclosed seas the effect of this type of dumping is eutrophication. This results in a greater need for oxygen in the area and when the oxygen is used up in this manner the fish stocks are seriously affected and could result in massive fish kills.<sup>1476</sup> The non-degradable sludge tends to settle in areas retaining dangerous bacteria and solids. When storm conditions prevail this material is disturbed and is deposited in the coastal zone. The sensitive eco-systems in these areas are therefore also greatly affected.<sup>1477</sup> While this and oil pollution of recreation areas may appear to be less important than the destruction of a food source many States depend on their resorts and recreational areas as their main source of gross domestic product.

Although it is not a direct consideration of LOSC, and should be controlled by national legislation, sea water is used in industrial processes, mainly in the fishing industries. The use of seawater could, however contribute to pollution of the sea. Other processes such as power stations and the marine diamond industry also use seawater. In addition a permit being a requirement to utilise sea water in this manner, standards are set for the treatment of the water after it has been used to enable it to be released back into streams and the sea.

<sup>1475</sup> Seibold n357 p299

<sup>1476</sup> ibid

<sup>1477</sup> ibid

## Pollution from Dumping

For centuries waste has been allowed to enter the sea, or it has been specifically dumped there, and little attention was given to the effects that these actions would have on the marine environment. In certain areas, however, concern must have been felt that harm could result from these actions. In the 16th Century the Dutch towns of Enkhuizen and Amsterdam cautioned foreign vessels to refrain from emptying ballast into the sea.<sup>1478</sup> When coastal States eventually became aware of the hazards and the damage that pollution was causing in their coastal zones their initial reactions were to ensure that the pollution was confined to areas as far from their own coasts as possible.<sup>1479</sup> While this scale of dumping was, for many years, only a matter of national concern, it soon became evident to the international community that they could not leave the control of pollution of the marine environment to coastal States. Conventions were considered necessary to preserve resources from pollution despite the existence of MARPOL and other conventions UNCLOS III considered pollution a threat to the Common Heritage of Mankind.<sup>1480</sup> With the exception of LOSC and a number regional agreements there are no international conventions dealing with land-based pollution of the marine environment.<sup>1481</sup> Dumping is regarded internationally as being different to the pollution that is caused by shipping. Dumping is an act for which a trip by a vessel may have been specifically arranged.<sup>1482</sup>

States Party are required to adopt legislation preventing, reducing or controlling pollution by dumping.<sup>1483</sup> South Africa has extensive marine pollution control legislation.<sup>1484</sup> It has, for example, enacted The Dumping at Sea Control Act 73 Of 1980 in accordance with being party to the London Dumping Convention.<sup>1485</sup> Dumping in territorial waters, in the exclusive economic zone and on the continental shelf of a coastal State may not be done without the permission of the coastal State. In accordance with LOSC the coastal State has to exercise control over possible pollution and to take responsibility for the consequences.<sup>1486</sup>

Of particular concern to coastal States is the disposal, by dumping, of radioactive waste and matter. While States have adopted legislation to prevent this type of dumping and to control the passage of vessels carrying hazardous material, the major concern is still the threat of accidents to vessels transporting the material. Unscrupulous dumping may have on the high seas. LOSC has made provision for the prevention of the dumping of radioactive material. If a Flag State is party to the Dumping Convention enforcement of the provisions of the Convention by the Flag State on its vessel is obligatory. If the Flag State is not party to the Convention enforcement on the high seas would be difficult.<sup>1487</sup>

## Pollution from Sea Bed Activities

It is generally accepted that, except for the domestic refuse and sewage generated on an installation, the major instances of pollution of this nature occur as a result of accidents taking place on the installation.<sup>1488</sup> An example of this is the accidental blow-out on the Norwegian oil well in the Ekofisk Field of the North Sea in 1977 when over 30 000 tons of crude oil spilt into the sea.<sup>1489</sup>

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<sup>1478</sup> *ibid* p3

<sup>1479</sup> Churchill n18 p215-216

<sup>1480</sup> van Meurs n1444 p40

<sup>1481</sup> WR Edson Australia and the Implementation of the Law of the Sea Convention Australian National University -Canberra Publication (July 1987) p 40

<sup>1482</sup> Churchill n18 p214

<sup>1483</sup> LOSC Article 210(1)

<sup>1484</sup> MA Rabie and JA Lusher "South African Marine Pollution Control Legislation" Acta Juridica(1986)

<sup>1485</sup> Convention on the Prevention of Marine Pollution by Dumping of Wastes and other Matter -London (1972)

<sup>1486</sup> LOSC Article 210

<sup>1487</sup> Dumping Convention n1453

<sup>1488</sup> Churchill n18 p214

<sup>1489</sup> Ekofisk Blow-out (1977) 81RGDIP1137, Churchill n18 p212



The coastal State should adopt laws and regulations within its area of jurisdiction,<sup>1490</sup> to prevent the pollution from the following;

- a) artificial islands,
- b) any installation or structure erected to explore or exploit marine resources
- c) any other structure erected in the exclusive economic zone or on the continental shelf.<sup>1491</sup>

The seabed in the South African zones, including the continental shelf claim, is regarded in South African law as unalienated State land and all mining activities in these areas are governed by the Mining Rights Act.<sup>1492</sup>

The exploration and exploitation of hydro-carbons are also responsible for the discharge of mud, oils and other wastes from the drilling rigs and pumping platforms. This will occur as part of the normal process and does not include the damage and pollution that could arise as a result of accidents when drilling or pumping.

### Pollution from Activities in the Area

States Parties are obliged to co-operate with the competent international organisations, and the Authority, in the protection of the marine environment under the control of the Authority.<sup>1493</sup> The Flag State of vessels operating in or passing through the Area and the State whose nationals are involved in activities in the Area must endeavour to protect the environment.<sup>1494</sup> While LOSC provides rights to the coastal State to ensure the protection and preservation of the marine environment in its exclusive economic zone it is required to protect the marine environment as a general obligation.<sup>1495</sup>

An example of an activity that could cause pollution and damage to the sea-bed is the mining of manganese nodules. These nodules are found on the surface of vast areas of the sea-bed.<sup>1496</sup> The methods used to recover the nodules include dredge heads that suck up matter from the sea-bed and what is not required is then discharged back into the sea and onto the seabed. This processes could seriously damage marine species found on the sea-bed.<sup>1497</sup>

### Pollution from Vessels.

From 1954 international conventions, and their amendments, improved control of the activities of vessels that could result in pollution.

In accordance with the provisions of (OILPOL)<sup>1498</sup> ships could discharge oil or oily wastes but only when under way and the amount discharged could not exceed 60 litres per mile. Tankers could not discharge more than 1/15000th of the vessel's total cargo carrying capacity and then not in certain designated areas or within 50 nm of the nearest land. The oily discharge from machinery spaces of any vessels could not exceed 100parts per million and should be as far from land as possible.<sup>1499</sup>

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<sup>1490</sup> LOSC Article 208

<sup>1491</sup> LOSC Article 60 and 80

<sup>1492</sup> South African Mining Rights Act No 20 of 1967

<sup>1493</sup> LOSC Articles 155(2), Annex 3 Articles 17 (1)(b)xii, & 17(2)(f)

<sup>1494</sup> LOSC Article 209

<sup>1495</sup> LOSC Article 192

<sup>1496</sup> Committee on the Seabed Utilisation n1152 p27

<sup>1497</sup> Chapter X

<sup>1498</sup> International Convention for the Prevention of the Sea by Oil (1954)

<sup>1499</sup> ibid

*There was wide agreement that about 80% of maritime casualties are caused, or aggravated by human error. Human error can never be eliminated, but reducing it must be a major priority.*<sup>1500</sup>

The 1960's and 1970's disasters of the supertanker *Torrey Canyon*, off southwest England in 1967, the supertanker *Olympic Bravery* off the coast of Brittany in January 1976, the tanker *Bohlen* in October 1976, the tanker *Argo Merchant* off the coast of Nantucket in December 1976 and the supertanker the *Amoco Cadiz* again off the coast of Brittany gave further impetus to the call to limit the dangers of maritime casualties, to control dumping and to limit pollution generally. These disasters not only resulted in the loss of the vessels and thirty lives, but over 700 000 tons of crude oil was discharged into the sea from these five disasters over a 11 year period alone.<sup>1501</sup>

Although sufficient provision for pollution control existed in the relevant conventions, UNCLOS III was faced with a situation that required provisions in LOSC to force States to abide by or to become party to these conventions. The conventions, and their amendments and LOSC, address most of the areas of concern of coastal and Flag States. States are required to enact legislation to give effect, mainly in their own waters, to the provisions of these conventions.<sup>1502</sup>

Discharge of oil is defined in MARPOL<sup>1503</sup> as ;

*any discharge of oil from a ship or a tanker or an off-shore installation into part of the sea which is a prohibited area and includes any escaping, spilling, leaking, pumping or dumping of oil from such ships, tankers, or off-shore installation into such part of the sea.*<sup>1504</sup>

In international conventions, such as the OILPOL and later MARPOL and the CLC<sup>1505</sup> a distinction has been made between 'operational discharge' and 'accidental discharge' of oil by vessels and installations.

'Operational discharge' is the relatively small amount of pollutants, oil and domestic waste, that enters the sea as a result of the normal operating of the vessel. In 1954, in accordance with OILPOL, this type of discharge was allowed outside of a line draw 50 nm from the coast. In 1969 this was amended to allow discharge in specific circumstances and under certain conditions but this was again amended in 1973 and 1978 in the MARPOL Convention to provide for enforcement.<sup>1506</sup>

LOSC increased the responsibility for enforcement and placed greater liability on the Flag State.<sup>1507</sup> States Party are required to take, individually or jointly, all measures, consistent with LOSC to prevent, reduce and control pollution of the marine environment from any source.<sup>1508</sup>

The measures include;

*pollution from vessels, in particular measures for preventing accidents and dealing with emergencies, ensuring the safety of operations at sea, preventing intentional and unintentional discharges, and regulating the design, construction, equipment, operation and manning of vessels.*<sup>1509</sup>

By far the largest amount discharged or lost into the sea from vessels is from the cargo carried. Collisions or strandings could cause the entire cargo of oil, noxious, or harmful substances to be lost into the sea. These incidents fall in the category of accidental discharge and are covered by the general

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<sup>1500</sup> Donaldson n1066 p91

<sup>1501</sup> Brittin n945 p95 and 143

<sup>1502</sup> van Meurs n1444 p53

<sup>1503</sup> International Convention for the Prevention of Pollution from Ships (1973 & 1978)

<sup>1504</sup> ibid section 9(1)(a)

<sup>1505</sup> International Convention on Civil Liability for Oil Pollution Damage (1969)

<sup>1506</sup> LOSC Annex 1

<sup>1507</sup> LOSC Article 42(5)

<sup>1508</sup> LOSC Article 194 (1)

<sup>1509</sup> LOSC Article 194(3)(b)

rules governing liability. At the request of a coastal State, Flag States are required to investigate any action by any of their nationals that has resulted in damage to the coastal State and, if necessary, to immediately institute legal proceedings, in accordance with their laws, against the parties concerned.<sup>1510</sup> Some of the operations of cargo handling require that holds and tanks be cleaned and, up to the coming into force of the London Dumping Convention, it has been customary for masters of vessels to discharge this washing effluent into the sea.<sup>1511</sup>

Coastal States are required to implement legislation and regulations to prevent pollution from vessels flying their flag in accordance with international conventions.<sup>1512</sup> They may also impose conditions on foreign vessels entering their ports to prevent pollution providing due publicity is given.<sup>1513</sup> This applies to passage through territorial waters or when vessels are using offshore terminals. Due regard should, however, be given to the right of innocent passage.<sup>1514</sup> The coastal State must co-operate with the competent international organisations to establish international rules and regulations to prevent collisions at sea and other damage to vessels that could result in pollution. Routing schemes designed to minimise the threat of collisions are encouraged in LOSC.<sup>1515</sup>

A conflict of interests between the coastal State, which is concerned about the possibility of pollution and the Flag State that demands freedom of navigation through exclusive economic zones resulted in a compromise in LOSC;

*The principle behind the compromise is that jurisdiction is conceded to the coastal State but only to the extent of enforcing international rules.*<sup>1516</sup>

The coastal State has jurisdiction, in the exclusive economic zone, as provided for in the relevant provisions of LOSC with regard to:

*the protection and preservation of the marine environment.*<sup>1517</sup>

Where a coastal State is able to substantiate evidence, submitted to the competent international organisation, that a particular area of its exclusive economic zone is in danger from pollution by vessels it may adopt preventative legislation and rules. These rules would be promulgated by the international organisation and come into effect 15 months later. Additional legislation may be adopted by the coastal State in the pursuance of this aim providing it does not interfere in the design, construction, manning or equipment standards of the vessels concerned.<sup>1518</sup>

LOSC contains Articles that require the States Parties to enforce the preventative legislation and to undertake what other steps necessary to minimise the pollution.<sup>1519</sup> The State is expected to conduct the necessary inspections while the vessels are in port and to prevent their sailing if it is considered that a risk of pollution exists. Where a foreign vessel is voluntarily within port jurisdiction or at an offshore installation the port State may, and is expected to, institute proceedings to enforce its anti-pollution legislation and to prevent the sailing of the vessel if pollution could result.<sup>1520</sup>

Coastal States may require a vessel in transit to provide information on its identity, port of registry and its last and next port of call if there is evidence that it has been responsible for pollution in that States territorial waters or exclusive economic zones. If the vessel refuses to provide the information, the coastal State has the right to inspect the vessel and, if there is evidence to substantiate the claim, the

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<sup>1510</sup> LOSC Article 217 (4)-(8)

<sup>1511</sup> Donaldson n1066 p46

<sup>1512</sup> LOSC Article 211 (2)

<sup>1513</sup> LOSC Article 211 (3) 1484 LOSC Article 211 (6)

<sup>1514</sup> LOSC Article 211 (3)(4)

<sup>1515</sup> LOSC Article 211 (1)

<sup>1516</sup> Devine n919

<sup>1517</sup> LOSC Article 59(1)(b)(iii)

<sup>1518</sup> LOSC Article 59(1)(b)(iii)

<sup>1519</sup> LOSC Part XII Section 6

<sup>1520</sup> LOSC Articles 218, 219 and 220

vessel may be detained and proceedings initiated against it. If the necessary financial securities or other guarantees are provided the vessel must be allowed to proceed.<sup>1521</sup>

Where a foreign vessel has to be investigated to clarify whether it was responsible for an act of pollution in the territorial waters or exclusive economic zone, the coastal State should delay the vessel for as little time as possible. Actions should be confined, initially, to the examination of its certification. If this should prove to be inadequate, a physical inspection of the vessel may be undertaken. A vessel, in port, may, however, be detained by the coastal State, if its condition is such that, by allowing it to sail, it poses a threat to the marine environment.<sup>1522</sup> Should a Flag State fail to instigate proceedings against its vessel for pollution, the coastal State may proceed with an action. It may also do so in the event of the damage being of a substantial nature. Penalties may not be imposed on foreign vessels if three years have elapsed from the time of the alleged incident.<sup>1523</sup> If action is taken against a foreign vessel the Flag State has to be advised as soon as possible.<sup>1524</sup>

In 1992 protocols to both CLC and the Fund Convention were drafted and came into force on 30 May 1996.<sup>1525</sup> The CLC protocol will enhance the protection currently available in terms of extant conventions as it raises the limit of liability from an aggregate of 14 million units of account to 59,7 millions. The Fund Convention protocol raises the compensation payable from 30 million units of account to 135 million. Both protocols increase pollution damage control in the exclusive economic zone and over that caused by tankers in ballast. Compensation for damage to the environment is also increased.<sup>1526</sup> In the special circumstances of straits and ice-covered areas the States bordering on these areas may adopt and enforce legislation to prevent pollution.<sup>1527</sup>

Sovereign immunity from this type of legislation and enforcement is granted to warships, naval auxiliaries, other vessels or aircraft owned or operated by a State and used at the time for non-commercial government business.<sup>1528</sup> It is beholden however on the Flag State of these vessels and aircraft to ensure that, while not impairing their capabilities, they comply as reasonably as possible with the relevant Articles of LOSC.<sup>1529</sup>

Enforcement against foreign vessels may only be undertaken by officials, warships, military aircraft or vessels and aircraft clearly identified as being on government service of the coastal State and that they have the necessary authority.<sup>1530</sup>

### Maritime Casualties

A maritime casualty is defined in Article 221(2) (See page 328)<sup>1531</sup>

In the event of a maritime casualty occurring, even beyond the territorial waters of the State, a State may take whatever actions are necessary to prevent the pollution of its zones or coastline.<sup>1532</sup> Flag States are to conduct an inquiry, by a competent person or persons, into any maritime casualty or incident of navigation on the high seas that causes loss of life, serious injuries, serious damage to vessels or installations or to the marine environment.<sup>1533</sup>

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<sup>1521</sup> LOSC Article 220

<sup>1522</sup> LOSC Article 226

<sup>1523</sup> LOSC Article 228

<sup>1524</sup> LOSC Article 231

<sup>1525</sup> South African Department of Transport File M93/32 (December 1996)

<sup>1526</sup> *ibid*

<sup>1527</sup> LOSC Article 233 and 234

<sup>1528</sup> LOSC Article 236

<sup>1529</sup> *ibid*

<sup>1530</sup> LOSC Article 224

<sup>1531</sup> LOSC Article 221(2)

<sup>1532</sup> *ibid*

<sup>1533</sup> LOSC Article 94 (7)

In 1971 an international convention<sup>1534</sup> established a fund to protect both the tanker operators and States that could suffer damage as a result of pollution caused by a maritime accident. In addition in 1969 an agreement came into effect whereby tanker owners were able to anticipate liability for damages from oil pollution.<sup>1535</sup> This agreement requires tanker owners to make provision to compensate for damage up to the lesser of either 160 US \$ per ton or 16,8 million US\$. It applies to vessels anywhere.

While OILPOL was the start of international attempts to control and prevent pollution of the maritime environment, the Stockholm Conference, held in 1972 led to the creation, by the UN General Assembly, of the United Nations Environmental Programme (UNEP). UNEP is required to encourage States to protect the environment and to recommend suitable policies for national and international application.<sup>1536</sup> Some regional and sub-regional treaties have been entered into such as those adopted in the Baltic, the Mediterranean and the Persian Gulf. Bi-lateral agreements have also been entered into between States that predominate in an area such as between Italy and Yugoslavia and between Sweden and Denmark.<sup>1537</sup> As many States had made formal efforts to reduce the threat by concluding treaties, LOSC was able to generalise in the pertinent Articles and to create an environment where all States Parties were required to comply with internationally accepted standards and conventions.<sup>1538</sup>

While there are substantial obligations in terms of these conventions to control pollution and dumping, LOSC has included Articles that highlight the threat that these two activities pose to the environment.<sup>1539</sup>

### **Pollution through the Atmosphere**

It is also possible for pollution to occur from material transported through the atmosphere.<sup>1540</sup>

Water participates in a hydrological cycle as vapour, liquid or ice and inseparably links the land and the sea. 97% of all the water on the earth is found in the oceans, 2% is ice, 1% is ground water, soil water, surface water and water in the atmosphere. The majority of the latter 3% is fresh water.<sup>1541</sup>

This fresh water travels back and forth between the land, the sea and lakes by the following means:

- a) evaporation or transpiration into the atmosphere;
- b) rain;
- c) percolation through the earth;
- d) transportation in rivers to lakes and seas.

By these natural processes a bio-geochemical cycle is also established which is essential for maintaining life both on land and in the sea. If pollution is allowed to enter the cycle however, it is capable of contaminating the essential elements of carbon, nitrogen, sulphur and phosphates.

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<sup>1534</sup> International Convention on Establishment of an International Fund for Compensation for Oil Pollution Damage (1971) (Fund Convention)

<sup>1535</sup> Tanker Owners Voluntary Agreement Concerning Liability for Oil Pollution (1969)

<sup>1536</sup> Degenhardt n1263 p158

<sup>1537</sup> Churchill n18 p217

<sup>1538</sup> LOSC Article 197

<sup>1539</sup> LOSC Articles 1(1)(5), 194(3)(a), 210

<sup>1540</sup> von Meurs n1444 p39

<sup>1541</sup> National Global Change Secretariat, Alfred Wegener Institute, Federal Republic of Germany Global Change: Our World in Transition (1991) p21

Pollution would also be capable of spreading from the land to the sea and from there to the beaches, seabed and to marine resources.<sup>1542</sup>

States Parties are expected to adopt legislation to prevent or control pollution through the atmosphere of their airspace from all sources under their jurisdiction. This must be done in accordance with international standards and in co-operation with the relevant and competent international organisation.<sup>1543</sup>

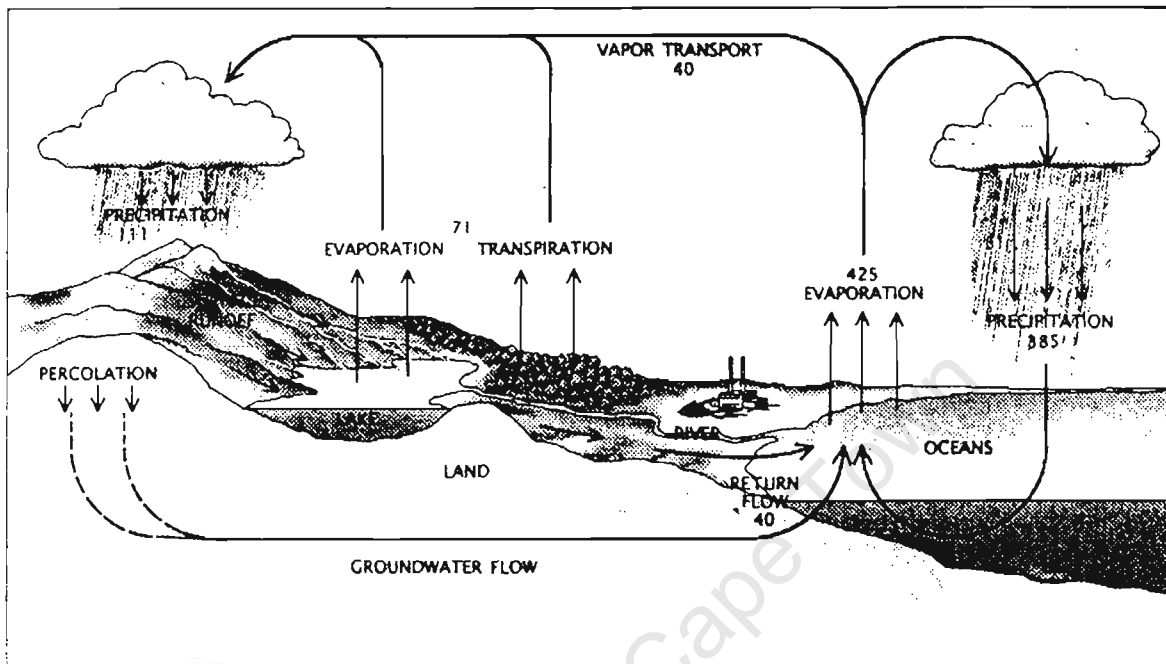


Figure 80 ATMOSPHERIC POLLUTION CYCLE

#### Pollution from Marine Scientific Research

UNCLOS III considered the control of marine scientific research as part of the concept of the Common Heritage of Mankind. While it is possible to declare an exclusive economic zone it may not be feasible for the State to harvest the benefits of the resources in the zones due to the lack of data, expertise or funding. It was felt during UNCLOS III therefore that not only should the exploitation of the resources in the zones be protected but also the scientific knowledge that would be gained by research programmes. Included in these rights is the protection of the marine environment.<sup>1544</sup>

It will be necessary to conduct research in the maritime zones to determine the extent of reserves and to establish optimum production and harvesting levels. In addition research may be undertaken for scientific or military purposes. This would include geological, hydrographic, and oceanographic research and could include drilling into the continental shelf, the use of explosives, the use of noxious substances, interference with the surface and subsoil of the ocean floor, the erection of structures and the discharge of waste.

While all States Party are entitled to conduct marine research programmes it is conditional on the protection of the rights of other States. These rights would include protection from damage and pollution of their marine reserves and environment.<sup>1545</sup> Although States that conduct research are required to promote actively the development and transfer of data and technology, particularly in developing States, great care should be taken by States conducting research whether it be in their own

<sup>1542</sup> *ibid*

<sup>1543</sup> LOSC Article 212

<sup>1544</sup> Churchill n18 p257

<sup>1545</sup> LOSC Article 238 & 246

maritime zone or, by consent, in another States area and the involvement of international organisations in the process is therefore important.<sup>1546</sup>

### Economic Factors

As a result of the number and size of ships at sea at any time, the ever increasing reliance on automated electronic navigational and safety systems and the types of cargoes that are now being transported by sea genuine concern is felt by all States for the protection of the environment. A collision, or a grounding, or even damage to a vessel as a result of sea or weather conditions, could result in catastrophic damage to the environment with serious economic consequences. These economic consequences could be as a result of damage to resources, the costs of efforts to protect the resources, the costs of attempts to minimise damage to them or the costs of rehabilitating an area after a catastrophe.<sup>1547</sup>

Shipping companies are, of necessity, profit-orientated. Many of the vessels that are used as carriers are sub-standard.<sup>1548</sup> In many instances the vessels are regarded as unseaworthy, they are not manned by adequately trained crews, and their instrumentation is sub-standard.<sup>1549</sup> Many vessels are beyond international control as their Flag States are not party to the relevant international conventions that ensure the quality of the vessels, their manning and instrumentation.<sup>1550</sup> Unless a vessel enters port no action can be taken against it or its owners with regard to seaworthiness or the competency of its crew.<sup>1551</sup>

Other vessels could be well found and have the latest instrumentation. Unfortunately the sophistication of the instrumentation is such that in many instances there is an almost total abdication of the traditional tasks undertaken by the bridge personnel, to automatic or computerised devices, necessary to avoid disasters by the personnel on board.<sup>1552</sup> The personal factor that could always override system failure is either non-existent or minimal. LOSC makes general provision for the protection of the environment including threats from pollution and requires States Parties to advise other States should it be aware of circumstances that are regarded as imminent danger to the environment.<sup>1553</sup>

Failure by States to ensure compliance of their vessels with this requirement or to maintain the standards contained in SOLAS and MARPOL will mean that vessels will remain a significant threat to the environment and thus to the economic well being of many States.<sup>1554</sup>

Efforts were made to reduce costly manpower on the bridge of merchant ships by submissions to the International Maritime Organisation. This was unsuccessful and the Report of the 69th IMO Maritime Safety Committee Meeting reflects the following after lengthy discussions:

*he (The Chairman) invited the Committee to agree as follows.....3.2 call upon Administrations, which had authorised ships to participate in trials, or which had authorised ships to continue the practice of solo watchkeeping in periods of darkness indefinitely, to cancel or discontinue such authorisations.*<sup>1555</sup>

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<sup>1546</sup> LOSC Article 240 & 266

<sup>1547</sup> Donaldson n1066 p33

<sup>1548</sup> *ibid* p11

<sup>1549</sup> *ibid*

<sup>1550</sup> SOLAS Convention n965

<sup>1551</sup> Donaldson n1066 p14

<sup>1552</sup> Report of the 69th Session of the IMO Maritime Safety Committee MSC69/22 (29 May1998)p93

<sup>1553</sup> Donaldson n1066 p24-26

<sup>1554</sup> *ibid*

<sup>1555</sup> IMO n1532 p93 para 21.31.3.2

States that take measures to prevent pollution in accordance with the provisions of LOSC may not unduly or unjustifiably interfere in the normal activities of States exercising their rights in the area and the State may not jeopardise adjoining areas by its efforts to prevent pollution in its own area.<sup>1556</sup>

States Parties have an obligation to protect and preserve the marine environment<sup>1557</sup> and they are also obliged to co-operate on a regional and a global basis with other States and competent international organisations to draft regulations and standards to achieve this.<sup>1558</sup> The co-operation should extend to an obligation to notify other States, and appropriate institutions, timorously, of imminent threats to the environment.<sup>1559</sup> The Authority is responsible for the drafting of rules and regulations for the conduct of vessels and other parties capable of causing pollution in the Area.<sup>1560</sup>

The co-operation must include the promotion of studies and research programmes to obtain the data necessary to prevent pollution and to establish the scientific criteria for this data to be of value.<sup>1561</sup> The damage that pollution can cause is divided into, that which harms man or his property or, that which harms the environment. Pollution that results in damage to man or his property can usually be addressed by the legal system of the State. In the case where damage is caused by events or activities outside the jurisdiction of a State, international mediation or arbitration is necessary. The Trail Smelter Arbitration<sup>1562</sup> was a claim by the United States against Canada for compensation for the damage resulting from toxic fumes emitted by a smelter on the Canadian side of the border. This resulted in the pollution of US crops and damage to livestock. States are obligated, *sic utere tuo ut alienum non laedes*, not to damage the resources of another State. The coastal State should adopt laws and regulations to prevent or minimise the pollution from rivers, estuaries, pipelines and outfall structures while taking due regard of the internationally accepted conventions related to this.<sup>1563</sup>

#### Responsibility of a Coastal State in LOSC

The Articles of LOSC place the responsibility for the protection of the environment in a coastal States zones on that State and these responsibilities will be considered first. Article 207 requires States Parties to adopt legislation

*to prevent, reduce, and control pollution of the marine environment..*

States are also expected to co-operate with one another and to harmonise their efforts on a regional basis and there is a requirement that other States co-operate in the measures undertaken by the coastal State.

The first responsibility of a coastal State is however to prevent pollution from land-based sources. These include pollution from rivers, estuaries, pipelines and outfall structures.<sup>1564</sup>

The coastal State is required to establish rules and regulations in accordance with internationally accepted procedures and practices.<sup>1565</sup>

These rules, laws and regulations shall include pollution from installations, artificial islands and structures and sea-bed activities.<sup>1566</sup>

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<sup>1556</sup> LOSC Articles 194 (4) and 195

<sup>1557</sup> LOSC Article 192

<sup>1558</sup> LOSC Article 197

<sup>1559</sup> LOSC Article 198

<sup>1560</sup> LOSC Article 145

<sup>1561</sup> LOSC Articles 200 and 201

<sup>1562</sup> Trail Smelter Arbitration III RIAA1905 (1941)

<sup>1563</sup> LOSC Article 207

<sup>1564</sup> LOSC Article 207(1)

<sup>1565</sup> LOSC Article 207(4&5)

<sup>1566</sup> LOSC Article 208(1)



Similar laws and regulations must be enacted by a coastal State in regard to dumping in the seas and oceans.<sup>1567</sup> In particular the permission of the appropriate authorities of the coastal State must be obtained before the dumping may be commenced.<sup>1568</sup>

The main consideration of LOSC appears to be the pollution from vessels. Article 211 contains the following provisions;

Section (1) requires the coastal State, acting through the competent international authority, to establish appropriate rules to prevent and control pollution of the marine environment. This could involve the adoption of routing systems where appropriate.

Section (2) requires coastal States to enact legislation to control their own vessels or vessels subject to their jurisdiction.

Section (3) requires the coastal State to give due notice and publicity of regulations introduced to control pollution by vessels entering ports, internal waters or who call at off-shore terminals. These regulations must also be conveyed to the appropriate competent international organisation.

In addition, in this section, a coastal State which has harmonised its policy with other States, is required to give due notice of this co-operation. This could then result in a vessels in passage through the territorial waters of a State, bound for another State, being requested by the first State to indicate to where it was enroute. If that State had harmonised its pollution legislation with the first State the vessel could be asked whether it complied with that legislation.

Section (4) While a coastal State may not hinder innocent passage in its territorial waters it may pass legislation and regulations to control marine pollution. The foreign vessels, regardless of innocent passage would be subject to these laws.

Section (5) The coastal State may likewise adopt laws and regulations to prevent and control pollution in its exclusive economic zone providing these laws are in accordance with Section (5).

Section (6)(a) A coastal State may identify areas of its exclusive economic zone sensitive or vulnerable to pollution that require special consideration. These areas, the proposed legal measures that the coastal State intends taking and supporting documentation must be submitted to the competent international organisation. This organisation must respond within 12 months of receipt of the submission and it supports the suggested legal steps the coastal State may enact the laws and regulations. These laws would be accordance with international laws and standards. They may only come into effect after 15 months from the date of the submission.

Section (6)(b) & (c) The coastal State must give due publicity to the limits of such an area and the coastal State may introduce additional laws and regulations to control the discharge of oil and the navigation practices of foreign vessels but it may not prescribe vessel design, construction, manning or equipment standards of the foreign vessels.

Article 212 deals with the control of pollution from the atmosphere. A coastal State may adopt laws and regulations to prevent reduce and control pollution of the marine environment through the airspace under their sovereignty taking into consideration of the agreed rules and international standards and practices for the safety of air navigation. States are also obligated to establish global and

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<sup>1567</sup> LOSC Article 210(1)

<sup>1568</sup> LOSC Article 210 (5)

regional standards and procedures, through international organisations, to prevent and control pollution via the atmosphere.

### **Enforcement**

Articles 213, 214 and 215 make provision for States to enforce their legislation, providing it is internationally accepted, in all zones including the Area. Article 216 makes provision for the enforcement of laws relating to dumping in the various zones and areas.

- a) The coastal State will be responsible for enforcement in its zones and on its continental shelf.
- b) The Flag State will be responsible for enforcement on the aircraft and vessels of its registry.
- c) Any State in regard to the loading of wastes and other matter in its territory and at its installations. A State is not obliged to institute proceedings when another State has done so in accordance with Article 211.

Article 217 contains obligations that Flag States must ensure that all vessels on their Register comply with the relevant international rules and regulations and must enforce compliance. If necessary the vessel must be prevented from sailing until it does comply. The vessels must be regularly inspected, and the vessels must carry with them certificates issued by their Flag State that they do comply. The Flag State is expected to act promptly in the event of one of its vessels being reported as having committed a violation and they should be accorded the necessary co-operation from other States involved. Requests for action by a Flag State should be in writing and after investigation if the vessel did violate accepted international standards then appropriate penalties should be imposed to discourage future violations. The State requesting the actions of the Flag State should be informed of the results and subsequent actions of the Flag State.

### **Enforcement by Port States**

When a vessel enters a port voluntarily and it is thought that this vessel has committed an offence in terms of internationally accepted rules and regulations the port State may undertake the necessary investigations and institute proceedings if necessary. The port State may receive requests for investigative action to be undertaken by another State, the Flag State or another State damaged or threatened with damage as a result of the suspected actions of a vessel. The port State should constantly appraise the flag and other coastal State of progress in the investigations and any proceedings commenced against the vessel. The State in whose waters the violation occurred may request that the port State suspend actions being undertaken of their behalf or in their interests.<sup>1569</sup>

Where a vessel is considered by the competent officers of a State to be unseaworthy and a possible pollution threat the port State may prevent the vessel from sailing to any destination except a convenient shipyard or repair quay. When the necessary repairs have been effected then the vessel should be allowed to proceed.<sup>1570</sup>

### **Enforcement by Coastal States**

A coastal State may institute proceedings against a vessel that has voluntarily entered its ports or is at one of its installations if it is thought that a violation has occurred in that State's territorial seas or exclusive economic zones. It may also be requested to act on behalf of another State. Also where there are clear indications that a violation has been perpetrated by a vessel sailing in the territorial waters of the State then the vessel may be boarded and inspected and proceedings instituted if necessary. If the violation occurred in a State's exclusive economic zone the vessel may be

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<sup>1569</sup> LOSC Article 218

<sup>1570</sup> LOSC Article 219

called on to provide information on its identity, Port of Registry, its last and next port of call and other information necessary to establish whether an offence has taken place.<sup>1571</sup> If a vessel refuses to provide this information it may be bordered and searched in accordance with the international rules and LOSC.<sup>1572</sup> If necessary the vessel may be taken into custody but it must be released should the necessary bonding or guaranties have been provided.<sup>1573</sup>

A coastal State may take all necessary action to protect its interests in the event of a maritime casualty.<sup>1574</sup>

The provisions found in Articles 220 and 221 are included in Article 222 with regard to enforcement actions that may be taken against aircraft that may be thought to have polluted or who may pollute the maritime environment via airspace.

### Safeguards

Many of the safeguards contained in LOSC appear in the Articles dealing with the rights and responsibilities of coastal States in the various zones.<sup>1575</sup> In particular LOSC introduces safeguards in the form of the following;

- a) measures to facilitate the proceedings arising from enforcement of pollution control regulations,<sup>1576</sup>
- b) enforcement must be by officials and official agencies of the coastal State and they may not, in the execution of their rights endanger the vessels by interfering with safe navigation or by sailing the vessel to or through unsafe waters.<sup>1577</sup>
- c) States may not discriminate against various vessels nor delay vessels unnecessarily,<sup>1578</sup>
- d) enforcement in straits,<sup>1579</sup>
- e) monetary penalties,<sup>1580</sup>
- f) liability of States arising from the enforcement actions.<sup>1581</sup>

### Ice-Covered Areas.

Where a coastal State has ice-covered areas landwards of the outer limits of its exclusive economic zone it may adopt and enforce non-discriminatory laws and regulations for the prevention and combating of marine oil pollution.<sup>1582</sup> The ice-covered areas pose extreme navigational hazards for vessels and this could lead to maritime disasters. Regardless of the cargo carried by the vessel the bunker fuel that could be discharged should the vessel's tanks be ruptured could seriously damage sensitive ecosystems. In addition the combating of the oil spill is made more difficult by the weather and climatic conditions in the area Article 234 permits Arctic States to adopt legislation but as no State has territory in Antarctica this Article does not apply. No provision is made in LOSC to combat

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<sup>1571</sup> LOSC Article 220(1)-(4)

<sup>1572</sup> LOSC Article 220(5)

<sup>1573</sup> LOSC Article 220(7)

<sup>1574</sup> LOSC Article 221(1)

<sup>1575</sup> LOSC Articles 59, 145, 162, 192-222

<sup>1576</sup> LOSC Article 223

<sup>1577</sup> LOSC Article 224-225

<sup>1578</sup> LOSC Articles 226-227

<sup>1579</sup> LOSC Article 233

<sup>1580</sup> LOSC Article 230

<sup>1581</sup> LOSC Article 232

<sup>1582</sup> LOSC Article 234

pollution in Antarctica but the strict ecological control of the south of 60 degrees south is catered for in the Antarctic Treaty.<sup>1583</sup>

### **Responsibility and Liability**

States are to discharge their responsibilities in accordance with all international conventions and treaties to which they are party and they are to ensure that their legal systems facilitate speeding resolutions in regard to settlements and compensation. They are also to co-operate in the implementation of international law.<sup>1584</sup>

### **Sovereign Immunity**

Naval vessels, whether warships or auxiliaries, and State vessels and aircraft are immune from the provisions of LOSC regarding the protection and preservation of the marine environment. Each State shall however endeavour to ensure that the activities of these vessels and aircraft comply with these provisions as much as possible.<sup>1585</sup>

### **Cables, Pipelines and Pollution**

The right to lay and maintain cables and pipelines over the sea bed in the exclusive economic zone and the continental shelf is provided for in LOSC.<sup>1586</sup> LOSC empowers the coastal State to explore and exploit the continental shelf and to prevent and control pollution from these pipelines without impeding the laying of these pipelines.<sup>1587</sup> In the exclusive economic zone the activities of other States in the laying of cables and pipelines may not interfere with the rights of the coastal State.<sup>1588</sup>

Pollution from submarine cables and pipelines usually occurs as a result of an accident. A pipeline can be damaged by trawling, anchoring of vessels and oil-rigs, sea-bed mining and other sea-bed activities. Pipelines are subject to wear and tear and poor maintenance could also result in pollution occurring.<sup>1589</sup>

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<sup>1583</sup> Antarctic Treaty n1320 Article IX (2)(f)

<sup>1584</sup> LOSC Article 235

<sup>1585</sup> LOSC Article 236

<sup>1586</sup> LOSC Articles 58 and 79

<sup>1587</sup> LOSC Article 79

<sup>1588</sup> LOSC Article 58(3)

<sup>1589</sup> Churchill n18 p243

## COMMENTED GLOSSARY OF TERMS RELEVANT TO POLLUTION USED IN LOSC

(Unless otherwise stated all definitions are taken from AJ Kerr, NR Guy et al IHO Manual on Technical Aspects of United Nations Convention on Law of the Sea 1982 3rd Ed 1993.)

### ALIEN SPECIES <sup>1590</sup>

*Species that are “out of harmony”<sup>1591</sup> with the ecosystem in which they are found.*

#### Comment

Alien species are introduced into an area either accidentally, as a result of the unintentional release of small numbers of the species, or purposefully, as a result of a specific programme or for exploitation reasons.

### DANGEROUS AND NOXIOUS SUBSTANCES <sup>1592</sup>

#### Nuclear, Oil and Oily Waste, and other Dangerous and Noxious Substances

Not specifically defined in LOSC or commentaries.

#### Comment

Although the substances considered dangerous are not defined any substance that can affect the ecosystems of the oceans are included in the Articles of LOSC. Nuclear powered vessels and the transportation of nuclear waste are two serious concerns of coastal States.<sup>1593</sup> Any substance that is considered dangerous to the marine environment is included. The transportation of dangerous substances has also been addressed in an international convention but as at June 1996 no States had become party to it.<sup>1594</sup>

### DISCHARGE <sup>1595</sup> (Vessel Sourced Pollution) <sup>1596</sup>

Not specifically defined in LOSC.

#### Comment

One of the sources of pollution that can be controlled is the discharge of waste, oil and other noxious substances from vessels and coastal and off-shore installations. International conventions have come into force to eliminate the washing of oil tanks by tankers in passage and to reduce the amount of discharge that occurs as a result of normal activities aboard vessels.<sup>1597</sup>

### DUMPING <sup>1598</sup> (Wastes) <sup>1599</sup>

Dumping means:

- a) *any deliberate disposal of wastes or other matter from vessels, aircraft, platforms or other man-made structures at sea;*

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<sup>1590</sup> LOSC Article 196(1)

<sup>1591</sup> Oxford Dictionary

<sup>1592</sup> LOSC Articles 22(2), 23, 42(1)(B), 194(3)(A), 207(5)

<sup>1593</sup> Argus Newspaper (6th February 1997)

<sup>1594</sup> Liability and Compensation for Damage in Connection with Carriage of Hazardous and Noxious Substances by Sea Convention (1996)

<sup>1595</sup> LOSC Articles 42(1)(b), 194(3)(b), 211(6)(c) & (7), 218(1),(2) & (3) 220(5) & (6), A3/17(2)(f)

<sup>1596</sup> LOSC Articles 1(1)(5)(a) & (b), 194(3)(b), 209(2), 210, 211, 216, 217-222, 228, 234, 236, 248(b) & (d), 249(1)(a), 255, A8/1, A8/2(1), A82(2), A8/5(1)

<sup>1597</sup> MARPOL n1435 and Protocols

<sup>1598</sup> LOSC Articles 1(1)(5), 194(3)(a), 210, 216, A3/17(2)(f), A8/1, A3/2(1) & (2), A8/2(2)

<sup>1599</sup> LOSC Articles 1(1)(5)(a)(i) & (b)(i), 145(a), 216(1)(c), A3/17(2)(f)

- b) *any deliberate disposal of vessels, aircraft, platforms or other man-made structures at sea.*<sup>1600</sup>

#### Comment

Discharges as a result of normal operations or the specific placement of matter for purposes that are not in conflict with the aims of LOSC are not regarded as dumping.<sup>1601</sup>

#### IMMUNITIES<sup>1602</sup>

*The provision of this Convention regarding the protection and preservation of the marine environment do not apply to any warship, naval auxiliary, other vessels or aircraft owned or operated by a State and used, for the time being only on government non-commercial service.*<sup>1603</sup> *Ships owned or operated by a State and used only on government non-commercial service shall, on the high seas, have complete immunity from the jurisdiction of any State other than the Flag State.*<sup>1604</sup>

#### Comment

Warships and government ships used for non-commercial purposes are immune from all enforcement of a coastal State but may be requested to leave the internal or territorial waters of a coastal State on the request of that State.<sup>1605</sup>

#### MARINE ENVIRONMENT<sup>1606</sup>

*A surrounding: conditions influencing development or growth*

#### Comment

The term 'marine environment' is used in LOSC in relation to the elimination or reduction of marine pollution.

#### MARITIME CASUALTIES<sup>1607</sup> (Prevention, Reduction and Combating of Pollution)

*For the purpose of this article 'maritime casualty' means the collision of vessels, stranding or other incident of navigation, or other occurrence on board a vessel or external to it resulting in material damage or imminent threat of material damage to a vessel or cargo.*<sup>1608</sup>

#### Comment

The *Torrey Canyon* disaster in 1967 was responsible for the 1969 Intervention Convention and the inclusion of Article 221 in LOSC.<sup>1609</sup> Subsequently international concern has resulted in the International Maritime Organisation being responsible for eight conventions or funds to prevent, reduce, control, and to provide funds to compensate for such damage.<sup>1610</sup>

<sup>1600</sup> LOSC Article 1(1)(5)(a)

<sup>1601</sup> LOSC Article 1(1)(5)(b)

<sup>1602</sup> LOSC Articles 29-32, 42(5), 95, 96, 110(1), 178, 182(a) & 236

<sup>1603</sup> LOSC Article 236

<sup>1604</sup> LOSC Article 96

<sup>1605</sup> LOSC Article 30

<sup>1606</sup> Dictionary n924 p1376, LOSC Articles 1(1)(4), 59(1)(b)(iii), 60(3), 94(7), 123(b), 145, 147, 155(2), 162(2)(x), 165(1),(2)(e),(h),(k),(l), 192-237, 290, 297(2), A3/2(1)(b), A3/13(6)(k), A3/14(2), A3/17(1)(b)(xii), A3/17(2)(f)

<sup>1607</sup> LOSC Articles 94(7), 211(7), 221(1) & (2)

<sup>1608</sup> LOSC Article 221(1)

<sup>1609</sup> Churchill n18 p152

<sup>1610</sup> Prevention of Pollution from Ships Convention 1973, 1978, Intervention on the High Seas in Cases of Oil Pollution Casualties 1969, Civil Liability for Oil Pollution Damage 1969, 1976, 1992, Civil Liability in the Field of Maritime Carriage of Nuclear Material 1971, Establishment of an International Fund for Compensation for Oil Pollution Damage 1971, 1976, 1992, Prevention of Marine Pollution by Dumping of Wastes and other Matter

## SAFETY ZONE <sup>1611</sup>

*The coastal State may, where necessary, establish safety zones around such artificial islands, installations and structures in which it may take appropriate measures to ensure the safety of both navigation and of the artificial islands, installations and structures.* <sup>1612</sup>

### Comment

Safety zones shall not exceed 500 metres around the artificial islands, installations and structures, except as authorised by generally accepted international standards or as recommended by the appropriate competent international organisation. <sup>1613</sup> In the interests of safety of installation and safe navigation, a safety zone maybe declared around the installation from its outermost points. It is incumbent on the coastal State to ensure that an adequate warning system is provided by the installation.

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1972. Oil Pollution Preparedness, Response and Co-Operation 1990, Liability and Compensation for Damage in Connection with Carriage of Hazardous and Noxious Substances

<sup>1611</sup> LOSC Articles 60(4)-(7), 111(2), 147(2)(c), 260

<sup>1612</sup> LOSC Article 60(4)

<sup>1613</sup> LOSC Articles 60(4) &(5)

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## CHAPTER XII

## ORGANISATIONAL STRUCTURES

## INTRODUCTION

LOSC contains provisions for the establishment of organisational structures that are intended to monitor, approve or disapprove of the actions of States in the implementation of LOSC. These organisations are fora in which the views of States are expressed. The effect that some of these organisations will be able to have is debatable. It is the intention to consider the organisational structures contained in LOSC prior to the Agreement and then to consider the effect that the Agreement has on the implementation of the Articles of Part XI.<sup>1614</sup> The organisations, provided for in LOSC are as follows;

- a) The Preparatory Commission for the International Sea-Bed Authority;<sup>1615</sup>
- b) The International Tribunal for the Law of the Sea
- c) The Sea-Bed Disputes Chamber;<sup>1616</sup>
- d) Arbitral Tribunals.<sup>1617</sup>
- e) Special Arbitration Tribunals<sup>1618</sup>
- f) The International Sea-Bed Authority;<sup>1619</sup>
- g) The Enterprise;<sup>1620</sup>
- h) The Commission on the Limits of the Continental Shelf

## PREPARATORY COMMISSION

The Prepcom was tasked to;

- a) prepare the provisional agenda and draft rules of procedure of the Assembly and the Council,
- b) exercise the powers and functions assigned to it by Resolution 11 of UNCLOS III relating to the preparatory investment.

<sup>1614</sup> UN Agreement n1262

<sup>1615</sup> LOSC Final Act Resolution I Annex I

<sup>1616</sup> LOSC Annex VI

<sup>1617</sup> LOSC Annex VII

<sup>1618</sup> LOSC Annex VIII

<sup>1619</sup> LOSC Part XI Section 4

<sup>1620</sup> LOSC Annex IV

- c) undertake the studies that may have to be undertaken for the establishment of a headquarters for the Authority,
- d) prepare the draft rules, regulations and procedures for Authority to commence its functions (such as financial management and internal administration),
- e) undertake studies on problems which would be encountered by developing landbased producer States likely to be most seriously affected by the production of minerals derived from the Areas, and how to minimise their difficulties,
- f) the adoption of all measures necessary for the early entry into effective operation of the Enterprise,
- g) prepare recommendations regarding practical arrangement for the establishment of the International Tribunal for the Law of the Sea and make recommendation on the following;
  - i) the budget for the first financial period of the Authority,
  - ii) the relationship between the Authority and the United Nations and other international organisations,
  - iii) the Secretariat.<sup>1621</sup>

The Prepcom comprised,

- a) a plenum (with a Bureau)
- b) special commissions (each with a Bureau) to deal with
  - i) land based mineral production
  - ii) the Enterprise
  - iii) a code for the mining of seabed minerals
  - iv) proposed Disputes Tribunal.
- c) a general committee comprising the members of a) and b), under the chairmanship of a)  
<sup>1622</sup>

UNCLOS III adopted the Resolution establishing the Preparatory Commission (Prepcom) to prepare the International Seabed Authority and the Law of the Sea Tribunal. The US decided that they would not contribute to the costs of the Prepcom, equivalent to approximately US\$ 1 million a year, as they would be financing aspects contrary to the interests of the US. They held that this financial requirement was illegal and not binding on the US. As the Prepcom preceded the establishment of other the organs of LOSC the attitude of the US is significant as it reflected to a greater or lesser degree the attitudes of many of the industrialised States to the envisaged organisational structures of LOSC. The US agreed to recognise the rights of States in their waters providing that these State recognised the rights and freedoms of the US and other States. On the 10

<sup>1621</sup> JL Kateka "The Status of the International Sea-Bed Authority: The Work of the PREPCOM" RB Krueger & SA Riesenfeld (eds) *The Developing Order of the Oceans* (1984) p200 U Jenisch "The International Seabed" C-h Park (ed) *The Law of the Sea in the 1980s* (1980) p176

<sup>1622</sup> Degenhardt n1263 p13

March 1983 the US proclaimed what was effectively a 200nm exclusive economic zone and issued deep seabed mining concessions to which the Soviet Union then protested.<sup>1623</sup>

Until the Agreement on the implementation of Part XI was entered into, the US policy on deep seabed mining is significant as consortiums from the US had been instrumental in much of the exploration undertaken up to that time. The US worked on the premise that deep seabed mining was a lawful use of the high seas.<sup>1624</sup>

Following on this premise, the US believed it could

- a) mine the deep seabed,
- b) acknowledge the right of other States to do likewise,
- c) accept responsibility for the actions of its national as engaged in these activities and ensure that the environment was protected and
- d) have due regard to the rights of nationals of other States, including those involved in deep seabed mining.<sup>1625</sup>

The US deep seabed mining activities are governed by the US Deep Seabed Mining Resources Act (1980)<sup>1626</sup> Although this Act was regarded by some as a US negotiating tactic the feelings of the US in regard to the initial composition of Part XI are reflected in this statement:

*Is deep seabed mining a freedom of the high seas in which states may join together to regulate themselves, having due regard for the rights of others? Or is there something legally unique about this activity that it has escaped from the classical legal doctrine? Does the international law of the sea legislate for those who have not consented to be bound in this realm? May the international community do so through a majority vote? The United States position does not purport to exclude the rights of others to engage in deep seabed mining. But others would seem to wish to exclude the United States from doing so.*<sup>1627</sup>

The US attitude, in 1982, to the implementation of Part XI of LOSC is significant as most of the experience and data from the initial exploration was undertaken, and is held by the US. There is therefore, an enormous US investment in technology and manpower. The organisational structures, in LOSC, to control activities in the Area did not receive US support. US President Reagan listed six objections to Part XI and stated that these issues had to be addressed before the US would consider being a party to LOSC. He stated that the deep seabed mining regime had to;

- 1) *not deter development of any deep seabed mineral resources to meet national and world demand,*
- 2) *assure national access to those resources by current and future qualified entities to enhance US security of supply, to avoid monopolisation of the resources by the operating arm of the international authority, and to promote the economic development of the resources,*

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<sup>1623</sup> *ibid* p10-11

<sup>1624</sup> DA Colson "Deep Seabed Mining: The United States Position" RB Krueger & RF Riesenfeld (eds) *The Developing Order of the Oceans* (1984) p233

<sup>1625</sup> *ibid*

<sup>1626</sup> *ibid*, BH Oxman "The Agreement and the Convention" *Law of the Sea Forum: The 1994 Agreement on the Implementation of the Seabed Provisions of the Convention on the Law of the Sea* *AJIL* Vol88 No4 (October 1994 ) p688

<sup>1627</sup> Colson n1604 p236

- 3) *provide a decision-making role in the deep seabed mining regime that fairly reflects and effectively protects the political and economic interests and financial contributions of particular States,*
- 4) *not allow for amendments to come into force without approval of the participating States, including, in the case of the United States, the advice and consent of the Senate,*
- 5) *not set undesirable precedents for international organisations, and*
- 6) *be likely to receive the advice and consent of the Senate. In this regard the convention should contain provisions for the mandatory transfer of private technology and participation by and funding of national liberation movements.*<sup>1628</sup>

During the Geneva Session of the Prepcorn in August 1984, eight industrialised States signed a provisional understanding on seabed matters. This was considered by the Group of 77 States, the Socialistic and some other States as being contrary to the Convention and was considered by them to null and void and illegal.<sup>1629</sup>

The Prepcorn remained in existence until the first session of the ISBA Assembly.<sup>1630</sup>

### THE INTERNATIONAL TRIBUNAL FOR THE LAW OF THE SEA

This Tribunal is to be established in the Hanseatic City of Hamburg in accordance with LOSC although it may exercise its functions anywhere whenever it deems appropriate.<sup>1631</sup> The Tribunal shall be organised as follows:

- a) It shall comprise 21 members elected for their integrity and competency in the field of the law of the sea.<sup>1632</sup> Eleven members will constitute a quorum.<sup>1633</sup>
- b) The composition of the Tribunal should reflect the principal legal systems of the world and the members should represent an equitable geographical distribution. There shall be no fewer than three members for each of the geographical areas as established by the UN General Assembly.<sup>1634</sup>
- c) States Parties may have only one national as a member at any one time and where there is dual citizenship the State where the member has previously exercised his citizenship the greatest shall be considered as his home State for the purpose of eligibility for election to the Tribunal.<sup>1635</sup>
- d) Nominations, elections, terms of office and vacancies are prescribed in the Annex.<sup>1636</sup>
- e) Members may not be involved in any activities that could be considered as being incompatible with their responsibilities as a Member. These include involvement in the resources of the sea or sea bed and by acting as an agent, council or advocate in any case. A Member is free to recuse himself from specific cases where he feels that he has, or has

<sup>1628</sup> Statement by the President "US Policy and the Law of the Sea" US Department of State Bulletin No544 (March 1982) PJ Standard "The Changing of the Guard: The US Signing of the Agreement relating to the Implementation of the 1982 Convention on the Law of the Sea" EM Borgese et al (eds) Ocean Yearbook 12 (1994) p55

<sup>1629</sup> Kateka n1601 p204

<sup>1630</sup> LOSC Resolution I (13), A Bernaert Bernaert's Guide to the Law of the Sea: The 1982 UN Convention (1988) p58

<sup>1631</sup> LOSC Annex VI, LOSC Article 1(2)

<sup>1632</sup> LOSC Article 2 Annex VI

<sup>1633</sup> LOSC Article 13 Annex VI

<sup>1634</sup> LOSC Article 2 Annex VI

<sup>1635</sup> LOSC Article 3 Annex VI

<sup>1636</sup> LOSC Article 4-6 Annex VI

had, vested interest, or he may be served notice to that effect by the President of the Tribunal. The President is also empowered to declare a vacancy should it be the unanimous opinion of the members that a member has not fulfilled his obligations as a member.<sup>1637</sup>

- f) The Tribunal may form special chambers of not less than three of its members to consider specific disputes and the judgements of these chambers will be considered as being a judgement of the Tribunal. The Sea-Bed Disputes Chamber is a chamber with specific composition and terms of references established in Section 4 of Annex VI.<sup>1638</sup>
- g) While a member must recuse himself in accordance with para e) above he may retain his seat on the Tribunal should a case be heard involving nationals of his State provided that the other States involved in the dispute may chose a member.<sup>1639</sup>

The Tribunal is open to States Parties and entities expressly provided for in Part XI LOSC<sup>1640</sup>

The Tribunal shall have jurisdiction over all disputes submitted to it and any other agreement that confers jurisdiction to the Tribunal.<sup>1641</sup> The Tribunal will apply international law consistent with LOSC but may, with the parties concerned, decide a case *ex aequo et bono*.<sup>1642</sup> The decisions of the Tribunal are by simple majority of votes and where there is equality for and against a decision the President or whoever is presiding may exercise a casting vote.<sup>1643</sup> The Judgement must detail the reasons on which it is based, who were the members of the Tribunal, was the decision unanimous and if there was a separate opinion it must accompany the judgement and then the judgement and opinions must be read in open court before the parties concerned.<sup>1644</sup>

Third or other parties who feel that they may be affected by any aspect of a possible judgement may submit a request to the Tribunal to intervene. If the Tribunal allows the intervention then the judgement will also be binding on the State that requested the intervention as well as the parties to the dispute.<sup>1645</sup>

### Sea Bed Disputes Chamber

This chamber is one of the chambers described in Section 1 Articles 14 and 15. It will comprise 11 members selected by the Tribunal from amongst its members and the criteria that were used when the Tribunal members were elected should be considered when selecting the members of the Disputes Chamber.<sup>1646</sup> *Ad hoc* Chambers comprising three members of the Chamber may be formed to deal with a specific dispute.<sup>1647</sup> The same law applied by the Tribunal will be applied by the *Ad hoc* Chambers. The decisions of the Sea Bed Dispute Chamber will be enforceable in the States party to the dispute.<sup>1648</sup>

- a) *the Parties may submit disputes to the three-member ad hoc chamber formed from the members of the Seabed Disputes Chamber or to a special chamber of the Tribunal of the Law of the Sea*

<sup>1637</sup> LOSC Articles 7-9 Annex VI

<sup>1638</sup> LOSC Articles 14-15 Annex VI

<sup>1639</sup> LOSC Article 17 Annex VI

<sup>1640</sup> LOSC Article 20 Annex VI

<sup>1641</sup> LOSC Article 21 Annex VI

<sup>1642</sup> LOSC Article 293

<sup>1643</sup> LOSC Article 29 Annex VI

<sup>1644</sup> LOSC Article 30 Annex VI

<sup>1645</sup> LOSC Articles 31 and 33 Annex VI

<sup>1646</sup> LOSC Article 35 Annex VI 1

<sup>1647</sup> LOSC Article 36 Annex VI

<sup>1648</sup> LOSC Article 39 Annex VI

- b) *Contractual disputes, including those involving the plan of work, with respect to the interpretation or application and financial terms in general and in particular with respect to transfer of technology are to be submitted to binding commercial arbitration (if the parties to the dispute do not agree otherwise). But tribunals for commercial arbitration have no jurisdiction on questions of interpretation of the Area provisions and the Annexes; such questions must be referred to the Seabed Disputes Chamber...;*
- c) *the Sea-Bed Disputes Chamber has no jurisdiction with regard to the exercise by the Authority of its discretionary powers; furthermore, it does not pronounce itself on the question of whether any rules, regulations and procedures of the Authority are in conformity with the Convention, nor does it declare invalid any such rules,.....*<sup>1649</sup>

## THE INTERNATIONAL SEABED AUTHORITY (ISBA or Authority)

The 'Area' is the main consideration of the ISBA and is defined in LOSC as the following:

*'Area' means the seabed and ocean floor and subsoil thereof, beyond the limits of national jurisdiction.*<sup>1650</sup>

All States Party to LOSC are *ipso facto* members of the ISBA but all States who signed LOSC and have not ratified it may only attend as observers.<sup>1651</sup> The ISBA organises and controls activities within the Area.<sup>1652</sup> As the ISBA has control over the Area it can contest the national limits that will, in turn, define the limits of the Area.<sup>1653</sup>

All activities in the 'Area' are under the authority of the Authority and it conducts its activities as follows;

- a) *conduct its own mining operations through its "enterprise"*
- b) *contract with private and state ventures by granting them mining rights in the Area.*<sup>1654</sup>

The seat of the ISBA is in Jamaica<sup>1655</sup> but regional centres may be set up as and when necessary.<sup>1656</sup> The Authority has an international personality and such legal capacity as is necessary to exercise its functions and fulfil its purposes.<sup>1657</sup>

During 1995 efforts were made to elect a Secretary General of the ISBA but this was unsuccessful due to the reluctance of developed States to have the ISBA instituted before the problems related to the implementation of Part XI were resolved.<sup>1658</sup> Ambassador Satya N Nandan has subsequently been elected as the Secretary-General. The ISBA has a number of principal organs, an Assembly, a Council and a Secretariat.<sup>1659</sup> In addition the Enterprise is established through which the ISBA is able to carry out projects in the Area as well as the functions of transporting, processing and marketing the minerals recovered from the Area.<sup>1660</sup>

<sup>1649</sup> Bernaert n1610 p62

<sup>1650</sup> LOSC Article 1(1)

<sup>1651</sup> LOSC Article 156(2) & (3)

<sup>1652</sup> LOSC Article 157(1)

<sup>1653</sup> Degenhardt n1263 p7-8

<sup>1654</sup> *ibid*

<sup>1655</sup> LOSC Article 156 (4)

<sup>1656</sup> LOSC Article 156 (5)

<sup>1657</sup> *ibid*, MC Manansala "Deep Seabed Mining" C-h Park & JK Park (eds) The Law of the Sea: Problems from the East Asian Perspective (1981) p549, MC Manansala "The International Seabed in the Law of the Sea: Some views from Developing Countries" C-h Park (ed) The Law of the Sea in the 1980s (1980) p151, LOSC Article 176, Bernaert n1610 p58

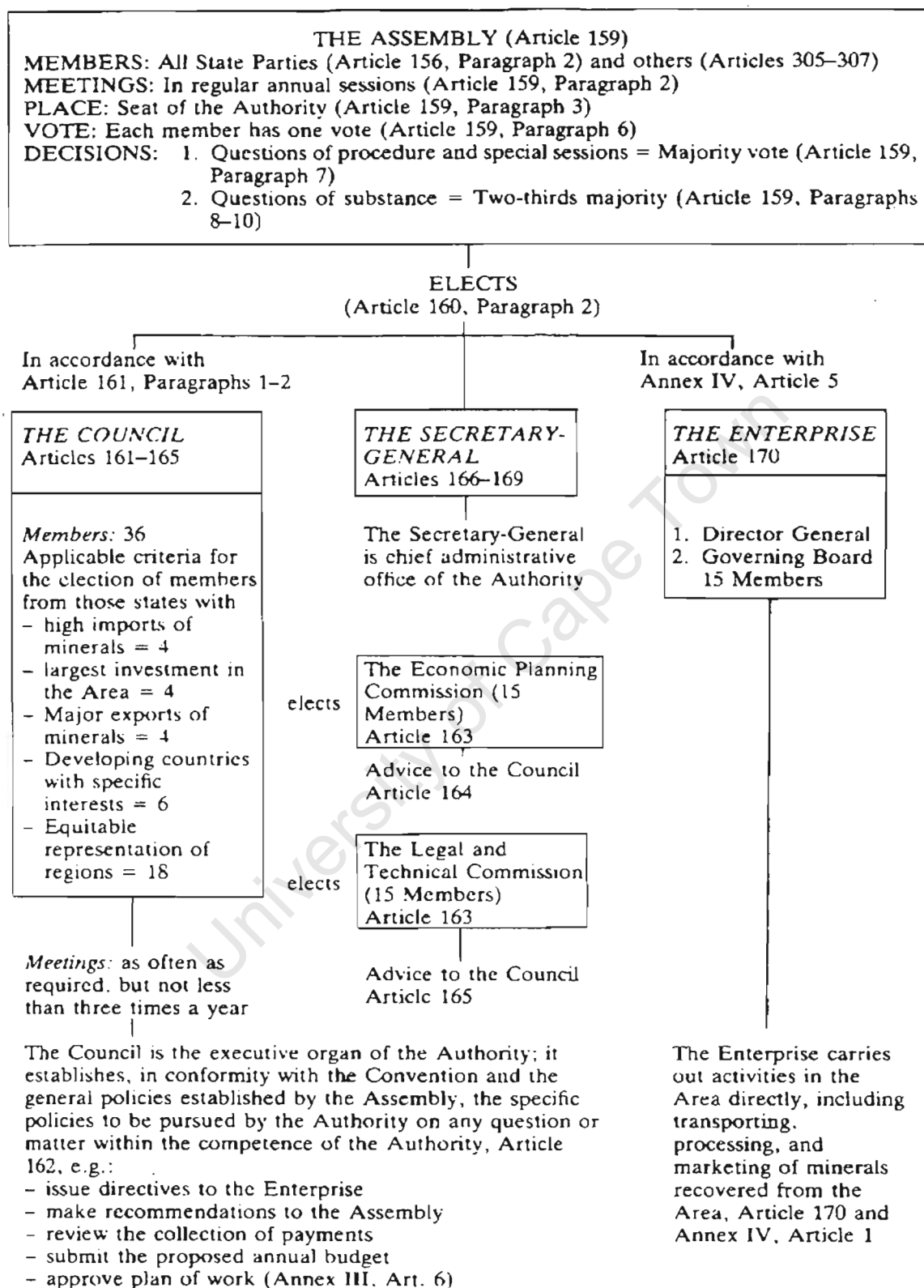
<sup>1658</sup> Groups of Experts Meeting n1

<sup>1659</sup> LOSC Part XI Section 4 Subsections B,C and D

<sup>1660</sup> LOSC Annex IV Article 12 Article 170 (1)

# THE ORGANIZATION OF THE AUTHORITY

## Articles 158–170



**Figure 81 THE ORGANISATION DIAGRAM OF THE ISBA**

All members of the ISBA have equal rights in the ISBA.<sup>1661</sup>

The authority to conduct research in the 'Area' appears to vary according to who is conducting the research. In the case of the Authority it may conduct marine scientific research concerning the Area and its resources.<sup>1662</sup> This would require approval of 75% of the Members of the Authority to commence the research, whereas States Parties may carry out marine scientific research in the 'Area'.<sup>1663</sup>

*The two most important of the Authority's decision-making organs will be the Assembly and the Council.*<sup>1664</sup>

## THE ASSEMBLY

In addition to other tasks allotted in terms of LOSC;

*The Assembly, as 'the supreme organ of the Authority to which other principal organs shall be accountable,' has the power to lay down general policies for the Authority which must, however, be consistent with the specific provisions of the Convention.*<sup>1665</sup>

Each member of the ISBA shall have one representative in the Assembly who may have alternates and advisors.<sup>1666</sup>

The Assembly shall hold annual sessions<sup>1667</sup> but may convene in the following circumstances;

- a) as decided by the Assembly;
- b) as requested by the Council;
- c) by a majority of the members of the Authority.<sup>1668</sup>

The President and other office bearers are elected at each session and remain in office until the next session when new office bearers may be elected. In addition, rules of procedure for meetings are agreed upon at the commencement of each session.<sup>1669</sup> A majority of members of the Assembly constitutes a quorum.<sup>1670</sup> This has been changed by the Agreement.

Each member has one vote and a simple majority of members present and eligible to vote is sufficient to pass all procedural motions including the calling of special meetings.<sup>1671</sup> The substance of motions will be decided by the Assembly and a decision that a motion is of substance requires a two thirds majority of those present and voting and participating in the session.<sup>1672</sup> A motion may be deferred on its first appearance for a maximum of five days provided this period does not extend

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<sup>1661</sup> LOSC Article 157(3)

<sup>1662</sup> LOSC Article 143(2)

<sup>1663</sup> *ibid.* RS Lee "Marine Scientific Research in the International Seabed Area" C-h Park (ed) The Law of the Sea in the 1980s (1980) p337

<sup>1664</sup> W Hauser "The Legal Regime for Deep Seabed Mining under the Law of the Sea Convention" (Trs FB Dielmann) Studies in Transnational Law of Natural Resources Vol 7 1983 p34

<sup>1665</sup> Churchill n18 p161

<sup>1666</sup> LOSC Article 159(1)

<sup>1667</sup> LOSC Article 159(2)

<sup>1668</sup> *ibid*

<sup>1669</sup> LOSC Article 159(4)

<sup>1670</sup> LOSC Article 159(5)

<sup>1671</sup> LOSC Article 159(6)&(7)

<sup>1672</sup> LOSC Article 159(8)



beyond the end of the session. A minimum number (20%) of the members of the Assembly may request the deferment.<sup>1673</sup>

Written submissions from at least 25% of the members of the Authority may request the President to obtain an opinion from the Sea-Bed Disputes Chamber whether a certain proposal is in accordance with LOSC. This opinion is required before the last week of the session. Failing this the Assembly is required to decide when it will reconvene to consider the proposal if it is in accordance with LOSC.<sup>1674</sup>

The ISBA may exercise the following powers and functions:

- a) The Authority is the supreme organ of the Authority to which the other organs are responsible.
- b) It may establish general policies in regard to the areas of responsibility as contained in LOSC.
- c) It must elect members of the Council and the Secretary-General from candidates nominated by the Council.
- d) From recommendations from the Council it must elect the Governing Board and the Director-General of the Enterprise.
- e) It must establish, on an equitable geographical distribution, any subsidiary organs as are necessary for it to fulfil its purpose role and functions in accordance with the relevant sections of LOSC.
- f) It must assess the financial contributions of the members to the administrative budget of the Authority which must be in accordance with the approved method and scales used for the regular budget of the UN.<sup>1675</sup>

As the ISBA is established to govern the Area, the most important functions of its Assembly are in LOSC from Article 160 (2)(f)-(n). They include the approval of the rules, regulations and procedures on the sharing of the economic benefits derived from the activities in the Area and the procedures for the sharing of the payments made by a coastal State when exploiting the resources of its continental shelf claim beyond 200 nm.<sup>1676</sup>

These regulations, rules and procedures must have been proposed by the Council and should take into account the situation of developing States and the recommendation of the Legal and Technical Commissions of the Council.<sup>1677</sup> In regard to the exploration and exploitation of polymetallic nodules the Assembly must give priority to establishing the rules and regulations and in the case of non-polymetallic the Assembly must adopt rules and regulations within three years of being requested to do so by the ISBA.<sup>1678</sup>

The Assembly must also;

- a) approve the annual budget of the Authority as submitted by the Council;

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<sup>1673</sup> LOSC Article 159(9), Churchill n18 p161

<sup>1674</sup> LOSC Article 159(10)

<sup>1675</sup> LOSC Article 160 (2)(a)-(e)

<sup>1676</sup> LOSC Article 82, 160(2)(f)-(n)

<sup>1677</sup> LOSC Article 165

<sup>1678</sup> LOSC Article 160(f)(i) and 162(o)(ii)

- b) examine reports emanating from the Council or the Enterprise;
- c) initiate studies and promote international co-operation concerning the activities in the Area;
- d) consider problems of a general nature;
- e) consider recommendations from the Economic Planning Committee of the Council;
- f) suspend the privileges of membership in the event of a State persistently or grossly violating the provisions of the Part of LOSC concerned;
- g) consider the distribution of questions to the various organs by the ISBA. <sup>1679</sup>
- h) examine reports from the Council and from the Enterprise and any other report requested by the ISBA;
- i) initiate studies and consider problems, particularly regarding developing States. <sup>1680</sup>

Restriction of the Assembly's broad powers <sup>1681</sup> are brought about by confining the Assembly's ability to establish general policies to be exercised as follows;

The Assembly shall have the power to establish general policies in conformity with the relevant provisions of this Convention on any question or matter within the competence of the Authority. <sup>1682</sup>

## THE COUNCIL

*The Council is the executive organ of the Authority and has the power to establish, in conformity with the Convention and the general policies established by the Assembly, the specific policies to be pursued by the Authority on any question or matter within the Authority's competence.* <sup>1683</sup>

*The Council is a powerful body, and while careful control of its composition would go some way towards safeguarding the various interests of States, it has also been seen as necessary to define its powers closely, and to establish a complex decision-making procedure.* <sup>1684</sup>

Would consist of 36 members of the ISBA elected as follows;

- a) four members from States Parties who can substantiate that over the last five years they have, consumed 2% of the total world's consumption or who have more than 2% of the world's imports of the commodities produced from the categories of minerals derived from the Area. One must be from the Eastern Socialistic States and the largest consumer;
- b) four members from the eight States Parties with the largest investments in preparations for activities in the Area, directly or indirectly through their nationals with at least one of these States being from the Eastern Socialistic States;
- c) four members from the States Parties that, on the basis of their production in areas under their jurisdiction, are major net exporters of these minerals. This must include at least two developing States whose exports have a major bearing on their economies;

<sup>1679</sup> LOSC Article 160

<sup>1680</sup> LOSC Article 162(2)(i)-(j)

<sup>1681</sup> LOSC Article 160(1)

<sup>1682</sup> *ibid*

<sup>1683</sup> Bernaert n1610 p60

<sup>1684</sup> Churchill n18 p162

- d) six members from developing States Parties with either large populations, or are landlocked, geographically disadvantaged, are major importers of these minerals, are potential producers of these minerals or are considered to be among the least developed States;
- e) eighteen members elected geographically from the following regions, Africa, Asia, Eastern European (Socialist), Latin America, Western European and Others with at least one member from each region.<sup>1685</sup>

Further these members should reasonably proportionately represent landlocked and geographically disadvantaged States and developing coastal States which do not qualify under Article 161(1a-d). Where possible those who do represent the various categories should be elected by the States in those categories.<sup>1686</sup> The Council will meet as often as necessary but at least three times a year.<sup>1687</sup>

The rights of the members are as follows;

- a) they each have one vote;
- b) approve procedural matters are resolved by a majority vote of members;
- c) approve with a two thirds majority of members present and voting matters of substance within the Councils mandate and with the approval of the Assembly such as;
  - i) agreements with the UN and other international organisations;
  - ii) the consideration of Enterprise Reports and recommendations thereon;
  - iii) annual reports to the Assembly;
  - iv) make recommendations to the Assembly based on advise from the Economic Planning Committee on compensation to assist developing countries suffering serious economic effects as a result of the mining of the minerals in question;<sup>1688</sup>
  - v) review the collection of payments made by or to the Assembly in regard to Part XI; vi) in the event of non-compliance the decisions of the Sea-Bed Disputes Chamber with recommendations from the Council should be notified to the Assembly.<sup>1689</sup>
- d) approve with a three fourths majority of members present and voting decisions on the following;
  - i) the compliance with all relevant sections of Part XI and advise the Assembly accordingly;
  - ii) propose a list of candidates for election as Secretary-General, members of the Governing Board and the Director-General of the Enterprise;
  - iii) adopt rules in regard to the selection of its president;
  - iv) exercise control over activities in the Area in regard to compliance with the regulations and provisions of Part XI, and with the approved plans of work;<sup>1690</sup>
  - v) select six months after coming into force of LOSC and thereafter every four months,<sup>1691</sup> from applicants for production authorisation;

<sup>1685</sup> LOSC Article 161 (1)

<sup>1686</sup> LOSC Article 161(2)

<sup>1687</sup> LOSC Article 161 (5)

<sup>1688</sup> LOSC Article 151 (10)

<sup>1689</sup> LOSC Article 162 (2) (f)(g)(h)(i)(n)(p)(v) & Article 191

<sup>1690</sup> LOSC Article 153 (3)(4)

<sup>1691</sup> LOSC Article 7(1) Annex III

- vi) submit to the Assembly for approval the annual budget of the Authority and recommendations in regard to policies within the competence of the ISBA,
  - vii) make recommendations to the Assembly in regard to the suspension of membership rights as a result of gross persistent violation of the provisions Part XI <sup>1692</sup>
  - viii) institute proceedings on behalf of the Assembly in regard to non-compliance with the provisions of Part XI.
  - ix) issue orders, for periods not more than 30 days, for the suspension or adjustment of operations in the Area that could cause serious damage to the marine environment, the decision to be taken by consensus; <sup>1693</sup>
- e) make decisions, by consensus, on questions of substance in regard to providing protection from the adverse economic effects suffered by developing States as a result of the decline in prices of minerals resulting from the mining of similar minerals in the Area. <sup>1694</sup> Make recommendations to the Assembly in regard to the rules and regulations, both financial and operational, for operations in the Area after considering recommendations from the Legal and Technical Commission. <sup>1695</sup>

*The Council's powers are divided into four different categories requiring differing voting majorities: the most important decisions must be made by consensus; for other decisions a three-fourths, a two-thirds or a simple majority is required.* <sup>1696</sup>

This has been changed by the Agreement.

'Consensus' means that no formal objection is lodged within 14 days of the submission for a proposal to Council. The decision to acknowledge an objection rests with the President of Council who must then act in accordance with the provisions laid down in LOSC. <sup>1697</sup>

### Organs of the Council

The two Commissions are the Economic Planning Commission and the Legal and Technical Commission. <sup>1698</sup> Each Commission has a minimum of 15 members elected by the Council from nominations made by States Parties and these candidates should have suitable qualifications to serve on a particular commission. <sup>1699</sup>

Due consideration has to be given to equitable distribution and representation of the members and no State Party may have more than one representative on a commission and no representative may serve on both commissions. <sup>1700</sup>

Members are elected for a term of five years and eligible for one further term. <sup>1701</sup> In the event of death, resignation or incapacity of a member, the Council may elect another representative from the same geographical area to complete the term. A member may not have any financial interests in any activity in the Area related to exploration or exploitation. <sup>1702</sup>

<sup>1692</sup> LOSC Article 185

<sup>1693</sup> LOSC Articles 161 (c) 162 (2)(a)-(e)(l)(q)-(u)(w)-(z) 163(2) 174(3) Article 11 Annex IV

<sup>1694</sup> LOSC Articles 150 (h) 151

<sup>1695</sup> LOSC Article 82, 161 162(m)(o)

<sup>1696</sup> Hauser n1644 p34

<sup>1697</sup> LOSC Article 161 (e)-(g)

<sup>1698</sup> LOSC Article 163(1), Bernaerts n1610 p60

<sup>1699</sup> LOSC Article 163(2)

<sup>1700</sup> LOSC Article 163(5)

<sup>1701</sup> LOSC Article 163(6)

<sup>1702</sup> LOSC Article 163 (7)&(8)

The Commissions must operate within the guidelines laid down for them by the Council and any rules and regulations formulated by the Commissions must be approved by the Council.<sup>1703</sup> The frequency of the meetings of the Commissions is governed by the necessity to fulfil their tasks.<sup>1704</sup>

### **Economic Planning Commission**

The membership of this Commission shall include at least two representatives of developing States whose economies would be, or are, substantially affected by the mining of certain minerals in the Area.<sup>1705</sup>

The functions of this Commission are as follows;

- a) propose measures to implement decisions in regard to the Area as requested by the Council;
- b) monitor the markets for the minerals of the Area with especial consideration given to developing States;
- c) monitor the possible adverse effects to developing States of activities in the Area and make recommendations to the Council in this regard;
- d) make recommendations to the Council on compensations to these developing States in the event of adverse effects being experienced.<sup>1706</sup> This has been changed considerably by the Agreement.

### **Legal and Technical Commission.**

This Commission shall comprise members with the requisite experience and qualifications in the exploration, exploitation and processing of the minerals to be found in the Area, oceanography, marine environmental protection or economic or legal expertise or in fields related to them.

The functions of the Commission are as follows;

- a) make recommendations on the implementation of functions of the Authority on the request of the Council;
- b) review and make recommendations on the plans for activity in the Area. These plans are formal written plans that could become part of the contract;<sup>1707</sup>
- c) upon the request of the Council supervise the activities in the Area and assess the impact of these activities on the environment. The Commission may make recommendations to the Council on the implementation of environmental protection plans, including pollution, and formulate rules and regulations on the sharing of the financial and other benefits arising from activities in the Area.<sup>1708</sup>
- d) make recommendations to Council on matters to be instituted before the Sea-Bed Disputes Chamber and on the implementation of decisions of this Chamber;
- e) make recommendations to Council on emergency measures to be taken to prevent serious damage to the marine environment and on the advisability of licensing mining operations

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<sup>1703</sup> LOSC Article 163 (9)

<sup>1704</sup> LOSC Article 163(12)

<sup>1705</sup> LOSC Article 164(1), Bernaerts n1610 p60

<sup>1706</sup> LOSC Article 164(2)

<sup>1707</sup> LOSC Article 153(3)

<sup>1708</sup> LOSC Article 162 (2)(o)

in the Area where areas that substantial evidence indicates that serious damage to the environment may result;

- f) the Commission shall make recommendations to the Council on the appointment and activities of inspectors to monitor activities in the Area and on the optimum production yields and ceilings for production in the Area.<sup>1709</sup>

## THE SECRETARIAT

The Secretariat comprises a Secretary-General and whatever additional staff the Authority may require.<sup>1710</sup> He is elected for a term of four years by the Assembly from a list of candidates provided by the Council, and may be re-elected. The Secretary-General is the chief administrative officer and acts in this capacity for all meetings of the Assembly, the Council, and any subsidiary organ.<sup>1711</sup> The Secretary-General and the staff of the Secretariat are to perform their duties and undertake their tasks on the instruction of the Authority.

These duties include;

- a) refraining from accepting instructions from any source other than the Authority;<sup>1712</sup>
- b) refraining from having any financial interests in any activity relating to the exploration or exploitation of resources in the Area.<sup>1713</sup> Failure to comply could result in the violation being submitted to a tribunal designated by the Authority, with the dismissal of the staff member concerned a possible consequence;<sup>1714</sup>
- c) consult, on matters within the competency of the Authority, with international and non-governmental organisations recognised by the Economic and Social Council of the United Nations;<sup>1715</sup>
- d) distribute written reports, submitted by non-governmental in terms of c) above, to States Parties.<sup>1716</sup>

## THE ENTERPRISE

The Enterprise is an organ of the ISBA which may carry out activities in the Area. The Enterprise is subject to the same rules and regulations applicable to other licensees in the Area.<sup>1717</sup> While the Enterprise is an organ of the ISBA it is not liable for the acts of the Authority nor is the Authority liable for its acts.<sup>1718</sup>

The Prepcom requested the UN Office of Ocean Affairs and Law of the Sea to prepare a Feasibility Study for the Enterprise. The document was intended to facilitate discussion within the Prepcom. The study analysed the various options open to the Enterprise as follows;

- a) the leasing of plant and equipment
- b) production sharing,

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<sup>1709</sup> LOSC Articles 151 (2)-(7) 165

<sup>1710</sup> LOSC Article 166(1), Bernaert n1610 p60

<sup>1711</sup> LOSC Article 166(3)

<sup>1712</sup> LOSC Article 168(1)

<sup>1713</sup> LOSC Article 168(2)

<sup>1714</sup> LOSC Article 168(3)

<sup>1715</sup> LOSC Article 169(1)

<sup>1716</sup> LOSC Article 169(3)

<sup>1717</sup> LOSC Article 170

<sup>1718</sup> LOSC Article 2(2) Annex IV, Bernaert n1610 p60, Jenisch n1601 p173

- c) service contracts,
- d) joint ventures and
- e) independent operations.

The developed States however advocated an effective, independent organ reflecting the basic principle of the Common Heritage of Mankind, and that of the industrialised States which wished the Enterprise to operate via joint ventures once seabed mining became commercially available.<sup>1719</sup>

This study assumed the implementation of a 3 million tonne nodule operation which would require a work force of approximately 1 600. The Study stated that 80%- 90% of the investment costs would occur between 1996-2000. It would appear, however, that these will have to be revised in view of the lack of interest in deep seabed mining at present.<sup>1720</sup>

The Enterprise shall have a Governing Board composed of 15 members elected on an equitable geographical basis and a Director-General and other staff as required.<sup>1721</sup> The term of membership is four years but a member may be re-elected.<sup>1722</sup> With the early departure of a member, for whatever reason, the Assembly elect a representative from the same geographical region to complete that member's term of office.<sup>1723</sup> The Director General is elected by the Assembly on the recommendations of both the Council and the Governing Board for a period not exceeding five years.<sup>1724</sup> He may be re-elected.<sup>1725</sup> He may not however be a member of the Board.<sup>1726</sup>

The Enterprise shall act independently of other bodies and States Parties and shall be run on sound commercial lines. The Board will receive remuneration from the funds of the Enterprise. While two thirds constitutes a quorum, a simple majority is required for approval of a matter before the Board.<sup>1727</sup> Concern was expressed prior to the coming into force of LOSC and the Agreement on the Implementation of Part XI that;

*In spite of some wording to the contrary, the Authority has the power to discriminate against firms that are not in joint ventures with the Enterprise. The partner of the Enterprise can rightfully expect discounts in fees and more advantageous conditions in the transfer of technology.*<sup>1728</sup>

The Governing Board may direct the activities of the Enterprise and conduct negotiations concerning the acquisition of technology, joint ventures, borrow funds and enter into legal proceedings, agreements and transactions to enable the Enterprise to exercise its functions, status, privileges and immunities as set forth in LOSC.<sup>1729</sup>

<sup>1719</sup> ED Brown "The 1994 Agreement on the Implementation of Part XI of the UN Convention on the Law of the Sea. Breakthrough to Universality" Marine Policy Vol 19 No1 (January 1995)

<sup>1720</sup> Degenhardt n1263 p14

<sup>1721</sup> LOSC Articles 4 and 5(1) Annex IV

<sup>1722</sup> LOSC Article 5(2) Annex IV

<sup>1723</sup> LOSC Article 5 Annex IV

<sup>1724</sup> LOSC Article 7 (1) Annex IV

<sup>1725</sup> LOSC Article 7(1) Annex IV

<sup>1726</sup> LOSC Article 7 Annex IV(1)

<sup>1727</sup> LOSC Article 1 & 5 Annex IV

<sup>1728</sup> HJ Martin "Deep Seabed Mining Between Convention and National Legislation" C-h Park (ed) The Law of the Sea in the 1980s (1980) p189

<sup>1729</sup> LOSC Article 6 Annex IV

### Finances of the Enterprise.

The Enterprise will make payments to the ISBA in accordance with Article 13 Annex III. This Article lays down the terms for the contracts between the ISBA and licensees. The ISBA will determine, on the recommendation of the Governing Board, the percentage that the Enterprise may retain from these funds as reserves.<sup>1730</sup> The remainder will be transferred to the ISBA. For the first ten years, after production has commenced, however, the ISBA will exempt the Enterprise from any payments.<sup>1731</sup> State Parties may contribute to the financing of the activities of the Enterprise.<sup>1732</sup> States Parties were obliged, however, to make available to the Enterprise, the necessary funds to explore and exploit one mine, with the transportation and processing of the minerals and the administrative expenses included.<sup>1733</sup> Half of these funds could have been in the form of interest free loans.<sup>1734</sup> The debt incurred by raising the balance of the amount required by the Enterprise is to be guaranteed by States Parties.<sup>1735</sup> This is to take place within 60 days of LOSC coming into force or within 30 days of the State Party's ratification or accession.<sup>1736</sup>

### Operations of the Enterprise

The Enterprise requires a plan of work approved by the Council.<sup>1737</sup> It may undertake the work itself or offer the work to tender. LOSC Article 12(3)(a) Annex IV The Enterprise holds title to all minerals mined and processed and may sell these without favour or discount.<sup>1738</sup>

*One of the most difficult subjects of negotiation at the Conference concerned the question of how to guarantee that the Enterprise will be provided with that technology.*<sup>1739</sup>

As will be seen from the Agreement on the implementation of Part XI this particular concern is compounded by the fact that requirements to supply technology have been reduced.<sup>1740</sup>

## AGREEMENT RELATING TO THE IMPLEMENTATION OF PART XI

### General Matters of Concern

On the 28th July 1994 an Agreement was adopted by the majority of member States of the United Nations.<sup>1741</sup> This Agreement effectively removed the reservations that the major industrialised States had in regard to the implementation of Part XI of LOSC. It has resulted in additional States ratifying LOSC but a significant number of developed States have not yet acceded or ratified.<sup>1742</sup> The most significant aspects of the Agreement however are found in the Articles dealing with the implementation of LOSC and the Agreement's relationship with LOSC. The States parties to the Agreement undertake to implement Part XI in accordance with the Agreement.<sup>1743</sup>

Where there is inconsistency between Part XI and the Agreement, the Agreement takes precedence. Articles 309 to 319 of LOSC make provision for States signing, ratifying or acceding to LOSC to make statements or declarations with a view to harmonising their laws with LOSC providing that these

<sup>1730</sup> LOSC Article 10(2) Annex IV

<sup>1731</sup> LOSC Article 10(3) Annex IV

<sup>1732</sup> LOSC Articles 10 & 11 Annex IV

<sup>1733</sup> LOSC Article 11(3)(a) Annex IV

<sup>1734</sup> LOSC Article 11(3)(b) Annex IV

<sup>1735</sup> *ibid*

<sup>1736</sup> LOSC Article 11(3)(b)-(d) Annex IV

<sup>1737</sup> LOSC Article 12(1) Annex IV

<sup>1738</sup> LOSC Article 12 Annex IV

<sup>1739</sup> Hauser n1644 p97

<sup>1740</sup> Agreement Annex Section 5

<sup>1741</sup> Message from the President of the United States U.S. Senate Treaty Doc. 103-39 (1994) p (III)

<sup>1742</sup> Agreement Article 2, S Haines "UN Convention on the Law of the Sea" Nautical Briefing Supplement to Seaways (The Journal of the Nautical Institute) (February 1995) p4

<sup>1743</sup> Agreement Article 1



statements do not modify or exclude in any way the effect of LOSC. These Articles also govern the times and manner with which LOSC may be amended. These provisions apply also to the Agreement.<sup>1744</sup> After the adoption of the Agreement any ratification of LOSC infers acceptance of the Agreement and willingness to be bound by it.<sup>1745</sup> A State must agree to be bound by LOSC if it consents to be bound by the Agreement.<sup>1746</sup> The Agreement would enter into force 30 days after 40 States had established their consent to be bound in accordance with Articles 4 and 5, providing that seven of the following States are included, Belgium, Canada, Federal Republic of Germany, France, India, Italy, Japan, the Netherlands, the Russian Federation, the United Kingdom of Great Britain and Northern Ireland and the United States of America.

In addition five of the States must be considered to be developed States.<sup>1747</sup> The manner which consent to be bound may be indicated is as follows;

- a) signature not subject to ratification, formal confirmation or the simplified procedure that allows a State that has already ratified LOSC to signify consent by just signing the Agreement. If a State has ratified but does not wish to avail itself of the simplified procedure it must do so at the time of signing the Agreement;
- b) Signature subject to ratification followed by the formal ratification;
- c) the simplified procedure;
- d) or by Accession.<sup>1748</sup>

If the Agreement has not come into force by the 16th November 1994 as prescribed it shall be applied provisionally by the following States;

- a) the States who consented to the adoption of the Agreement in the General Assembly of the United Nations unless the State had indicated before 16th November 1994 that its consent in the General Assembly did not signify consent to be bound by the Agreement;
- b) States that sign the Agreement, providing that they have indicated in writing that they do not consent to be bound;
- c) States that specifically consent to the provisional implementation;
- d) States that accede to the Agreement.<sup>1749</sup>

It is submitted that one of the most important aspects of the Agreement is that provision is made in the Agreement for States who comply with the requirements above, but who have not as yet ratified or acceded to LOSC, be regarded as States Parties for the purposes of the Agreement which is directly related to Part XI. It is emphasised in the Agreement that the establishment of the various bodies and organs has to be by means of an evolutionary approach. This was to minimise the costs in the early stages of establishment.<sup>1750</sup> It was further agreed that the early functions of the Authority would be undertaken by the Assembly, the Council, the Secretariat, the Legal and Technical Commission and the Finance Commission.<sup>1751</sup> The Economic Planning Commission's work would

<sup>1744</sup> Agreement Article 2(2)

<sup>1745</sup> Agreement Article 4 (10)

<sup>1746</sup> Agreement Article 4 (2)

<sup>1747</sup> LOSC Resolution II(1)(a) Final Act Annex I

<sup>1748</sup> Agreement Article 4(3)

<sup>1749</sup> Agreement Article 7

<sup>1750</sup> Agreement Annex Section 1(2)

<sup>1751</sup> Agreement Annex Section 1(4)

be undertaken by the Legal and Technical Commission until the first plan for exploitation has been approved or until the Council decides otherwise.<sup>1752</sup>

Until then the ISBA would concentrate on the following;

- a) processing the plans for work approvals;
- b) implementation of the recommendations of the Prepcom in regard to the rights and obligations of the pioneer investors and their certifying States;
- c) monitoring the plans to explore in the Area and the relevant trends in mining and processing, the world markets and mineral prices and prospects;
- d) monitor the possible effect of mining on the land based producers.

In addition the ISBA is expected to concentrate on adopting the rules and regulations necessary for all activities in the Area including the protection of the marine environment.<sup>1753</sup> Included in these sections is it implicit that the ISBA should concentrate on plans for work in the Area, valid for 15 years in the case of exploration.<sup>1754</sup> Exploitation may then be considered or an extension of the period of exploration. The Council is authorised to approve plans of work for exploration in the Area provided that the application has been approved in accordance with Annex III of LOSC by the Legal and Technical Commission.<sup>1755</sup> An expenditure of US\$ 30 million on research and exploration with US\$ 3 million being spent in the area specified in the plans of work would be considered as sufficient for the State or entity to qualify financially.<sup>1756</sup>

A registered pioneer may request approval of a plan of work within 3 years of the coming into force of LOSC. The plan of work for exploration would be for a period of 15 years after which the contractor is obligated to extend the period of exploration or to submit a plan of work to exploit the reserved area.<sup>1757</sup> The period of exploration extension may not exceed 5 years.<sup>1758</sup> This could be awarded, dependant on the good faith with which the responsibilities as a contractor have been discharged.<sup>1759</sup> If the contractor failed to abide by, and implement, the terms of the Agreement the plan of work would expire.<sup>1760</sup> In terms of the Agreement the ISBA will perform the duties of the Enterprise until it is able to operate independently.<sup>1761</sup>

These duties include the following;

- a) the monitoring of trends and development of seabed mining and related matters;
- b) assessing research activities and their environmental impact within the Area;
- c) assessing the data relating to prospecting in the Area;
- d) assessing technological developments affecting the Area;
- e) evaluating data relating to areas reserved for the ISBA;

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<sup>1752</sup> *ibid*

<sup>1753</sup> Agreement Section 1(5)(f)-(k)&(6)

<sup>1754</sup> *ibid*

<sup>1755</sup> *ibid*

<sup>1756</sup> Agreement Section 1 para 6(1)

<sup>1757</sup> Agreement Annex Section 1(9)

<sup>1758</sup> *ibid*

<sup>1759</sup> Agreement Section 1(9)

<sup>1760</sup> Agreement Section 1 (11)

<sup>1761</sup> Agreement Annex Section 2(1)

- f) assessing joint ventures;
- g) monitoring the availability of trained manpower;
- h) studying managerial and administration options for the Enterprise during all its stages of development.<sup>1762</sup>

The Enterprise is expected to conduct its initial deep seabed mining operations by way of joint ventures.<sup>1763</sup> The Enterprise is subject to the directives and control of the Council. If the accord is based on sound commercial principles, the Council shall issue directives in accordance with LOSC.<sup>1764</sup>

### Finance

A major change under the Agreement is that States Parties will no longer be expected to finance one mine site for the Enterprise or any joint-venture arrangements.<sup>1765</sup>

### Decision Making and Membership of the ISBA and its Organs

General policies of the ISBA shall be set by the Assembly in consultation with the Council and shall be by consensus.<sup>1766</sup> If this is not achievable then voting shall be in accordance with the provisions of LOSC.<sup>1767</sup>

On matters where the Council has competence, the Assembly shall base its decisions on the recommendations of the Council.<sup>1768</sup> Where there is disagreement between Assembly and Council, the Council shall reconsider its recommendations in the light of the Assembly's objections.<sup>1769</sup> Where there is still a lack of agreement the Council shall vote on procedural matters with a simple majority and on matters of substance with a two thirds majority of those members present and voting.<sup>1770</sup> The provisions in LOSC dealing with similar procedures shall not apply.<sup>1771</sup>

Council and Assembly decisions on financial matters should be based on the recommendations of the Finance Committee.<sup>1772</sup>

Decisions on questions of substance related to Council and Assembly matters normally require a two thirds majority of those members present and voting providing that they include a majority of the Council.<sup>1773</sup> Decisions applicable to the powers of the Council as contained in Article 162 require a three quarters majority of Members and with a majority of the Council present and voting.<sup>1774</sup> Neither of these two requirements shall apply as a result of the Agreement.<sup>1775</sup>

Before the Agreement was signed, the US would have had no guarantee of a seat on the Council. As the Council has the authority to establish policies on any question or matter within the competence

<sup>1762</sup> Agreement Section 2 (1(a) - (h))

<sup>1763</sup> Agreement Section 2 (2), LOSC Article 170 (2)

<sup>1764</sup> *ibid*

<sup>1765</sup> Agreement Annex Section 2(3)

<sup>1766</sup> Agreement Section 3 (1)(2)

<sup>1767</sup> LOSC Article 159(8), Standard n1608 p56, Oxman n1606 p689

<sup>1768</sup> Agreement Annex Section 3(4)

<sup>1769</sup> *ibid*

<sup>1770</sup> Agreement Section 3 (4)(5)

<sup>1771</sup> LOSC Article 161 (8)(b)(c)

<sup>1772</sup> Agreement Annex Section 3(7)

<sup>1773</sup> LOSC Article 161 (8)(b)

<sup>1774</sup> LOSC Article (8)(c)

<sup>1775</sup> Agreement p 273

of the Authority,<sup>1776</sup> the US felt it must have a guaranteed role in the Council. <sup>1777</sup> Paragraph 15 of Section 3 of the Agreement lists the 36 members of the Authority as comprising the following;

- a) four members from States Parties who have consumed over the last five years for which records are available 2% of the worlds total consumption or have had net imports of those commodities produced from minerals derived from the Area. Included in the four must be one member from an Eastern European region having the largest economy in terms of gross domestic product in that region and the State with the largest economy in terms of gross domestic product at the time of entry into force of LOSC;
- b) four members from the eight States which have made the largest investments in preparation and conduct in the Area directly or through their nationals.
- c) four members from States Parties who, on the basis of production in areas under their jurisdiction are major net exporters of minerals to be derived from the Area. Two of the four members must be from developing States whose economies are substantially dependent on such minerals;
- d) six members are to come from developing States Parties with special interests such as large populations, landlocked or geographically disadvantaged, major exporters of the minerals concerned, States who are potential producers of these minerals and least developed States;
- e) eighteen members elected on the principle of equitable geographical distribution with at least one member from the following regions; Africa, Asia, Eastern Europe, Latin America and the Caribbean and Western Europe and Others. <sup>1778</sup>

This replaces Article 161 (1) of LOSC. Each of the groups listed in sub paragraph a) b) and c) above act as chambers when voting in the Council and those in sub-paragraph d and e will be regarded as a single chamber for voting purposes. <sup>1779</sup> States that are eligible for election in more than one category may only represent one of them. <sup>1780</sup> The number of candidates is restricted to the number of seats required and where they exceed the number of seats available the system of rotation will apply. <sup>1781</sup>

#### Commissions and General Voting Procedures

The Legal and Technical Commission may make recommendations on the approval of work plans which the Council must approve unless a two thirds of the members of the Council present and voting decide otherwise. <sup>1782</sup>

If the Council fails to approve a recommendation within a prescribed period of time, normally 60 days unless otherwise agreed by the Council, it is deemed to have done so. <sup>1783</sup> The Council may also approve a plan of work not recommended by the same voting procedure. <sup>1784</sup> This replaces the provisions of Article 162 (2)(j) of LOSC. The decisions of the Legal and Technical Commission shall be by a simple majority of members present and voting. <sup>1785</sup> Where a dispute arises the normal dispute

<sup>1776</sup> Agreement Annex Section 1 (15)(e)

<sup>1777</sup> *ibid* p273

<sup>1778</sup> Agreement Annex Section 1 (15)(e)

<sup>1779</sup> *ibid* p273

<sup>1780</sup> *ibid*

<sup>1781</sup> *ibid*

<sup>1782</sup> Agreement Annex Section 3(11)

<sup>1783</sup> *ibid*

<sup>1784</sup> *ibid*

<sup>1785</sup> Agreement Annex Section 3(13)

procedures contained in LOSC will apply.<sup>1786</sup> Part XI subsections B and C dealing with the composition, procedures, voting, powers and functions of both the Assembly and the Council will still apply.<sup>1787</sup>

Certain provisions contained in LOSC dealing with the Review Conference, LOSC Article 155, will no longer apply. The only two portions retained are paragraphs (2) and (5).<sup>1788</sup> The Review Conference will still ensure that the concept of the Common Heritage of Mankind is maintained in relation to the activities in the Area and that these do not prejudice the interests and rights of States Parties.<sup>1789</sup> LOSC makes provision for the amendment of the Articles of LOSC dealing with the Area.<sup>1790</sup> This is extended in the Agreement.<sup>1791</sup>

### Technology

LOSC makes provision for the exchange of technology.<sup>1792</sup>

This has been applied in the Agreement as the following;

- a) the Enterprise or a developing State may seek the necessary deep sea mining techniques on reasonable terms on the open market. or through joint ventures;
- b) should this not be possible States Party will co-operate fully with the Authority to obtain the technology on the open market at reasonable terms;
- c) States Parties undertake to promote scientific and technical co-operation in the Area between the States or by the provision of training and scientific and technological programmes. The protection and preservation of the environment is also to be a responsibility of the States Parties;<sup>1793</sup> This replaces Article 5 Annex III of LOSC.

The US, and other developed States objected to the mandatory transfer provisions of LOSC.<sup>1794</sup>

*such technology must first be sought on fair and reasonable commercial terms and conditions on the open market, or through joint venture arrangements.*<sup>1795</sup>

### Production Policies

A production policy was agreed which has resulted in the following Articles or paragraphs of Articles of LOSC not being applied:

- a) LOSC Article 151 (1-7 )and (9).

These paragraphs deal with the authority of the ISBA over the production policies that applied in the Area. The paragraph retained deals with rights and obligations relating to unfair economic

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<sup>1786</sup> LOSC Article 187

<sup>1787</sup> Agreement Annex Section 3 (14)

<sup>1788</sup> Agreement Annex Section 4

<sup>1789</sup> *ibid*

<sup>1790</sup> LOSC Articles 314, 315, 316

<sup>1791</sup> Agreement Annex Section 4

<sup>1792</sup> LOSC Article 144

<sup>1793</sup> Agreement Annex Section 5

<sup>1794</sup> Standard n1608 p56, JM van Dyke & DL Teichman "Transfer of Seabed Mining Technology: A Stumbling Block to US Ratification of the Convention on the Law of the Sea" DM Johnson & NG Letalik (eds) The Law of the Sea and Ocean Industry: New Opportunities and Restraints Law of the Sea Institute Sixteenth Annual Conference (1982) p518-519, Oxman n1606 p691

<sup>1795</sup> Brown n1699 p11-12, Agreement Section 5.1 1(a)

practices under multilateral trade agreements for the exploration and exploitation of the mineral resources of the Area.<sup>1796</sup>

b) LOSC Article 162 (2)(q).

The agreement not to implement this sub-paragraph removes the power and authority of the Council to select, for production authorisation purposes, from applications in accordance with LOSC Annex III Article 7.<sup>1797</sup>

c) LOSC Article 165 2(n).

The authority of the Legal and Technical Commission to calculate the production ceiling and to issue production authorisations on behalf of the ISBA, following the selection of applicants, shall not be applied.<sup>1798</sup>

d) LOSC Article 6 (5) Annex III.

In relation to production policies in the Area LOSC contains provisions for an interim period to begin five years before 1 January of the year in which the earliest commercial production is planned to commence. The production will have to be in accordance with approved plans of work. This will not be applied.<sup>1799</sup>

e) LOSC Article 7 Annex III.

This Article deals with the selection among applicants for production authorisations and will not be applied.<sup>1800</sup>

The two paragraphs, (8) and (10) of Article 151 that may still be applied relate to the following;<sup>1801</sup>

- a) rights and obligations of unfair economic practices under relevant multilateral trade agreements for exploration and exploitation. Settlement of disputes by States Parties can be achieved by the implementation of these of dispute procedures in the agreement;
- b) Should a developing State suffer serious adverse economic effects to their exports earnings resulting from a reduction of the price of the commodity because of activities the Council may, on the recommendation of the Economic Planning Commission establish a system of compensation or economic adjustments.

The section containing the new production policy contains the following;

- a) development within the Area must be in accordance with sound commercial principles.<sup>1802</sup>
- b) The provisions of the General Agreement on Tariffs and Trade (GATT) will apply to activities in the Area. Sec 6 1(b) There may not be any form of subsidisation of activities in the Area unless in accordance with GATT;

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<sup>1796</sup> LOSC Article 151 (8)

<sup>1797</sup> Agreement Annex Section 6(7)

<sup>1798</sup> ibid

<sup>1799</sup> ibid

<sup>1800</sup> ibid

<sup>1801</sup> Agreement Annex Section 6 (7)

<sup>1802</sup> Agreement Annex Section 6 (1)(a)

- c) there may not be any preferential access to markets of these products, in particular, by means of discrimination in regard to tariff or non-tariff barriers and by preferences given by States Parties to their own enterprises and nationals.
- d) plans of work must contain schedules of anticipated production and the maximum amount of minerals expected to be processed during the period of the work plan;
- e) the provisions of Article 151 (8) of LOSC relating to dispute settlements are restated in Section 1 (f) of the Agreement with the addition that States Parties who are party to GATT may have recourse to the dispute settlement procedures available in LOSC;
- f) the Council may be requested by a State Party to take appropriate measures in the event of prohibited subsidisation or where there is adverse economic effects being felt by a developing State.<sup>1803</sup>

The Agreement requires that the provisions contained in GATT must be met to the point where the Authority is required to develop rules, regulations and procedures that will ensure that this will happen.<sup>1804</sup> LOSC Articles 151 (10), 160 2(1), 162 2(n), 164 2(d) 171 (f) and 173 2(c) that allow for the Council to compensate developing States Party that suffer economic effects, as a result of the exploitation of minerals from the Area, will be implemented in accordance with the following;

- a) the Authority will establish a fund from excess revenue derived from contractors, including the Enterprise;
- b) developing land based producer States suffering the economic deprivation shall benefit from this fund;
- c) the assistance will be given in co-operation with existing global and regional development institutions;
- d) the assistance will be specific to the circumstances being experienced by the developing State.<sup>1805</sup>

LOSC provides for the financial terms of contracts in great detail.<sup>1806</sup> With the exception of paragraphs (1) and (2) which deal with the guidelines for the objectives of the Authority and the cost of an application all sections of LOSC Article 13 Annex III up to, and including paragraph 10, will not apply.<sup>1807</sup> It has also been agreed that paragraph (2) will be implemented with a lower application fee, namely US\$ 250 000 instead of US\$ 500 000.<sup>1808</sup>

## Contracts

In the Section dealing with financial terms of contracts the Agreement provides for the following to be implemented:<sup>1809</sup>

- a) the system will be fair and adequate means of monitoring the contractor are allowed;
- b) the rates of payment under the system will be comparable with land based operations to avoid preferential treatment being giving to either type of contractor;

<sup>1803</sup> Agreement Annex Section 6 (1)

<sup>1804</sup> Agreement Annex Section 6 (7)

<sup>1805</sup> Agreement Annex Section 7 (2)

<sup>1806</sup> LOSC Annex III Article 13

<sup>1807</sup> Agreement Annex Section 8(2)

<sup>1808</sup> Agreement Annex Section 8(3)

<sup>1809</sup> Agreement Annex Section 8 (1)

- c) the system should be uncomplicated and should not require extensive administration by the Authority. A system of royalty payments or profit sharing will be considered with the contractor opting for the system of his choice;
- d) an annual fee will also be necessary from the time of the start of production;
- e) the system of payments will be flexible and non-discriminatory and changes to existing contracts will be mutually agreed upon;
- f) the dispute settlement procedures contained in LOSC will be used in the event of a dispute arising.

In accordance with the Agreement and LOSC Article 162 (2)(y) a Finance Committee is to be established with 15 members with appropriate financial competency. Only one national of a State Party may be a member at any time and members will be elected by the Authority.<sup>1810</sup> As usual due regard to equitable geographical representation and the interests of special groups when electing the members should be considered. Agreement Annex Section 9(3)

### THE COMMISSION ON THE LIMITS OF THE CONTINENTAL SHELF

LOSC provides for the establishment of this Commission to make recommendations on claims made by coastal States to continental shelf beyond 200nm from baselines.<sup>1811</sup> This Commission is set up under Annex II of LOSC. The recommendations relate to the determination of the outer limits of a State's continental shelf. The composition of the Commission is as follows;

- a) it shall comprise 21 members who shall serve in their personal capacities,
- b) these members shall be considered to be experts in the fields of geology, geophysics or hydrography,
- c) they will be elected by the States Parties from among their nationals,
- d) when electing due regard is to be taken of equitable geographical representation.<sup>1812</sup>

The members should be elected within 18 months of the coming into force of LOSC.<sup>1813</sup>

The functions of the Commission are listed as follows;

- a) consider the data and material submitted by coastal States that are States Parties in regard to the determination of the outer limits of their continental shelf. This should be related to Article 76 LOSC and the Statement of Understanding adopted by the UN Conference on Law of the Sea on 29 August 1980,
- b) the Commission may advise member States if requested by them<sup>1814</sup>

The Commission may co-operate with other international organisations with a view to exchanging information that may assist it in deliberations.<sup>1815</sup>

<sup>1810</sup> Agreement Annex Section 9(2)

<sup>1811</sup> LOSC Article 76 (8), Bernaerts n1610 p86

<sup>1812</sup> LOSC Article 2 Annex II

<sup>1813</sup> LOSC Article 2 Annex II

<sup>1814</sup> LOSC Article 3 Annex II

<sup>1815</sup> LOSC Article 3(2) Annex II



The coastal State is required to establish its claim in accordance with Article 76 LOSC and appropriate national procedures. The necessary scientific and technical data to substantiate the claim must be submitted.<sup>1816</sup>

The Commission shall operate by way of sub-commissions. A sub-commissions set up to consider a claim shall not comprise members from the coastal State making the submission nor from any State that assisted with the claim.<sup>1817</sup> The sub-commission will make its report to the Commission, in which those members who recuse themselves from appointment to the sub-commission may take part in the proceedings of the sub-commission.<sup>1818</sup>

If the Commission accepts the recommendations of the sub-commission it must be with a majority of two thirds. These recommendations are then conveyed to the coastal State in writing.<sup>1819</sup> Annex II The coastal State is required to resubmit a claim to the Commission within a reasonable, but unspecified, period of time if it is disagreement with the recommendations of the Commission.<sup>1820</sup>

A study-meeting was conducted by the UN Office of Ocean Affairs and Law of the Sea in New York from 11-14 September 1995. The meeting was held in conjunction with an invited group of experts to determine guidelines that a newly elected Commission could consider as its *modus operandi* when considering claims.<sup>1821</sup>

The recommendations were broken down into the following categories:

#### **Requirements for, and Analysis of, Data Submitted to the Commission.**

##### **a) Overall Considerations**

While a coastal State is entitled to maximise its claim in accordance with Article 76 the Commission has to satisfy itself that this is in fact the case, that adequate evidence has been supplied to substantiate the claim, that the data is sufficiently comprehensive enough to be able to draw conclusions and that the data used is to satisfactory standards. The data may be collected by various methods and consideration should be given by the Commission to the availability of the latest technology, or lack of it, to a coastal State when considering its submission. The Commission may consider advising coastal States at an early stage of the benefits of adopting a universal vertical reference datum. This would simplify subsequent evaluation by the Commission and the possibility of the Commission requesting that a submission be related to an acceptable datum at a late stage.<sup>1822</sup>

##### **b) Requirements for and analysis of Bathymetric and Seismic Data**

It was recommended that the Commission consider whether the fulfilling of some of the criteria required absolute accuracy in bathymetry as an example. Where a maximum change in slope determines the position of the foot of the slope its horizontal position is vital but the actual depth at which this takes place is not very relevant. The position from a system which can do this accurately by profiling should be acceptable. Where depth data is accurately required as in the case of the position of the 2500 metre isobath then the bathymetry should be of the highest standard.

<sup>1816</sup> LOSC Articles 4 & 7 Annex II

<sup>1817</sup> LOSC Article 5 Annex II

<sup>1818</sup> *ibid*

<sup>1819</sup> LOSC Article 6(3) Annex II

<sup>1820</sup> LOSC Article 8 Annex II

<sup>1821</sup> UN DOALOS Special Publication SPLOS/CLCS/INF/1 dated 10 June 1996, Minutes of the Meeting of the UN Group of Experts on the Continental Shelf UN Ref SPWS/CLCS/INF (September 1995)

<sup>1822</sup> *ibid* p5

It should also be noted by the Commission that it is not only profiling that will classify various undersea features such as ridges, plateaux, caps and rises but their geological formation and content. Scales of the various maps and charts are critical to the accuracy of the data and where possible the largest scale charts should be used for determinations. Smaller scale maps and charts should be used for illustrating only.<sup>1823</sup>

The Commission should also consider the original purpose for which the data was collected. It is possible (See Chapter VII) that the only data available, without extensive and expensive surveys being undertaken, is bathymetry collected for the preparation of nautical charts. These charts are intended purely for the safe passage of vessels.

The Commission should be entitled to know the accuracy of the systems used to collect all data. This would include the methods used to fix a position horizontally and vertically, or to determine the composition and location of sub-structures.<sup>1824</sup>

#### **c) Requirements and Analysis of Geodetic Data.**<sup>1825</sup>

State deposit maps and geodetic data with the Commission. This is to ensure that more accurate geodetic related positions of critical points are available instead of imprecise positioning from maps. Data submitted without reference to a geodetic datum is of little value. (See Chapter IV)

#### **d) Satisfying the 200 nm Rule**

As the Commission considers continental shelf claims beyond 200 nm from the baselines of a coastal State, the position of these baselines is important to the evaluation of any claim lodged with the Commission. The co-ordinates of these baselines have to be lodged with the Secretary General of the UN<sup>1826</sup> The Commission has no responsibility to ensure the accuracy.

#### **e) Satisfying the Rules relating to the Foot of the Continental Slope**

##### **i) 60 nm from foot of the slope.**<sup>1827</sup>

This is a complicated process as the example normally considered in explanations indicates a simple slope with an obvious change in gradient.<sup>1828</sup> The actual situation could be extremely complicated with multiple changes in slope, low gradients making a maximum change difficult to identify, and scarcity of data. The intervals between lines of profiles may also vary depending on the complexity of the marine geology in an area. The Commission would therefore be obliged to satisfy itself that adequate data over a sufficiently large area is surveyed.<sup>1829</sup>

##### **ii) Sediment thickness criteria.**<sup>1830</sup>

Due to the complexity of the processes and their accuracy's the Commission is encouraged to insist on the seismic data submitted being to certain standards such as the following:

<sup>1823</sup> ibid

<sup>1824</sup> ibid p7

<sup>1825</sup> LOSC Article 76(9)

<sup>1826</sup> LOSC Article 6(1)

<sup>1827</sup> LOSC Article 76 (4)(b)

<sup>1828</sup> Churchill n18 p, IHO n192 p14

<sup>1829</sup> SPLOS n1609 p12-14

<sup>1830</sup> LOSC Article 76 (4)(a)(i)

As the sediment thickness is determined by the time taken for an acoustic wave to pass twice through the sediment the thickness of the sediment and subsequently the distance to the foot of the slope is affected by errors in the recorded time of the wave. The submission should therefore have data with 'time' as the vertical scale and not 'depth' and any velocity data related to the determinations should be submitted.<sup>1831</sup> Coring information would also have to be provided.

It is suggested that the following are questions that the Commission should consider.

- a) What is the database for sedimentary thickness?
- b) If a contour map has been used, is the survey control adequate/acceptable for definition of the limits of the shelf every 60 nm?
- c) If profiles have been used, are they close enough to provide for definition of the limits of the shelf every 60 nm?
- d) What is the evidence of basement beneath the sediment?
  - i) Drill core- Definitive parameters?
  - ii) Seismic character- Qualitative parameter?
  - iii) Seismic velocity- Quantitative parameter?
  - iv) Were these data obtained by refraction, or velocity analysis from multi-channel data, or sonabouys?
  - v) Gravity, magnetic or other geophysical data- Indirect or interpretative?

It may be necessary for the Commission to weight the data when analysing a claim.<sup>1832</sup>

- e) Satisfying the 350 nm from baselines maximum criterion.

As in the determination of the outer limit of the 200 nm from baselines the accuracy's of these baselines when used for the determination of the 350 nm maximum criterion is not the responsibility of the Commission. The Commission is not authorised to evaluate the baselines from which maritime zones are measured even though the outer limit of an exclusive economic zone forms the inner boundary of the area that the a coastal State is claiming when submitting its claim to the Commission. The Commission's sole task is to evaluate the validity of the outer limit of the claim. It may however satisfy itself as to the geodetic correctness of the 350 nm distances from the baselines.<sup>1833</sup>

- f) Satisfying the 100 nm from the 2500 metre isobath criterion.

Whether a submarine ridge can be regarded as an integral part of a continental margin is a major consideration in continental shelf determinations. The 2500 metre isobath generates an outer limit up to 100 nm seawards from it and should a submarine ridge be part of a margin the 2500 metre isobath drawn around the ridge could extend a claim considerably. As a result the Commission is advised to obtain the necessary proof from the coastal State that any ridge included in the determination is part of the margin.<sup>1834</sup>

<sup>1831</sup> SPLOS n1801 p14

<sup>1832</sup> ibid p15-16

<sup>1833</sup> ibid p16

<sup>1834</sup> ibid

It is further suggested that the following additional information should be obtained by the Commission.

- a) How was the 2500 metre isobath determined including the database and the navigation systems used?
- b) Was the 2500 metre isobath a continuous line or were there isolated areas surrounded by a 2500metre isobath seawards of the continuous one?
- c) The determination of the outer limit, 100 nm from the isobath, should be geodetic based, if profiles were used they should not be more than 60 nm apart. Finally were the co-ordinates correctly computed?<sup>1835</sup>

## II) Format and Disposition of the Material

LOSC requires a coastal State to deposit with the Secretary General;

*charts and relevant information, including geodetic data permanently describing the outer limits of its continental shelf.*<sup>1836</sup>

Scientific and technical data must also be submitted in support of the claim.<sup>1837</sup> The fate and classification of this data and the method of submission is not stated in LOSC. The Commission must therefore decide not only on the format of submission but on its confidentiality. A lengthy list of suggested data and format was suggested to the Commission as being either a basic requirement or optimum information for the Commission to reasonably consider a claim.<sup>1838</sup>

In view of the requirement for coastal States to submit their claims within 10 years of the coming into force of LOSC, the Commission was advised to issue its instructions and suggestions as soon as possible.<sup>1839</sup>

## III) Conceptual Modus Operandi for the Commission

It was proposed that the Commission adopt the following modus operandi for itself.

There should be an initial submission through the Secretary-General of the United Nations to the Commission. This submission should be an executive summary of the full submission to be considered later by the subcommission. The initial submission would indicate the outer limits of the claim and the general manner in which these limits were determined. Over the next few months due publicity would be given by the UN through its normal channels and the submission considered in broad context by the Commission. At a full sitting of the Commission the initial submission would be considered and a Sub-Commission appointed to consider the full submission.<sup>1840</sup>

The Sub-Commission would then arrange its programme of meetings and serious consideration should be given to meeting in the coastal State submitting the claim. This would allow interaction with those responsible for the surveys and computations, data would be readably accessible, sensitive data could remain in the coastal State and large storage of data need not be provided for at the UN. It would also be possible for the Sub-Commission to advise a coastal State with limited expertise. Costs to both the Commission and the coastal State could be reduced.<sup>1841</sup>

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<sup>1835</sup> ibid p16-17

<sup>1836</sup> LOSC Article 76(9)

<sup>1837</sup> LOSC Article 4 Annex II

<sup>1838</sup> SPLOS n1801

<sup>1839</sup> ibid p18

<sup>1840</sup> ibid p20

<sup>1841</sup> ibid p21-22

After the Sub- Commission submits its report to the Commission it is considered and with a two thirds approval the report is forwarded to the coastal State and the UN Secretary General. The coastal State is expected to amend or resubmit within a reasonable period of time.<sup>1842</sup> What is not clear is whether the recommendations are binding on the coastal State.

*The limits of the shelf established by a coastal State on the basis of these recommendations shall be final and binding.*<sup>1843</sup>

*In the case of disagreement by the coastal State with the recommendations of the Commission, the coastal State shall, within a reasonable period of time, make a revised or new submission to the Commission.*<sup>1844</sup>

The reasonable period of time is not specified nor is there any reference governing the situation where subsequent submissions by the coastal State are still not satisfactory to the Commission. It is also not clear what the situation would be should a coastal State make its initial submission within the 10 years specified and then fails to resubmit an amended claim in accordance with the recommendations of the Commission. It is possible, therefore, for continental shelf claims, that are contentious, to remain unresolved, and for the Commission and the Secretary-General of the United Nations to be frustrated in their efforts to have their requirements incorporated in a coastal State's claim.

#### IV) Technical Resources Needed by the Commission

While the Commission will not undertake any form of survey, it may wish to investigate certain data supplied, and to compare it with data already held by the UN and other international organisations. To this end access to this data should be possible and facilities should be available to examine, thoroughly, the submissions made.<sup>1845</sup>

### REACTIONS TO THE AGREEMENT ON THE IMPLEMENTATION OF PART XI

Representatives of United States licensed mining consortia prepared a paper which they appended to their testimony before the United States House of Representative's Oceanography Subcommittee of the House Committee on Merchant Marine and Fisheries on 15 March 1994.<sup>1846</sup> In this report these licensees, who probably constitute the major parties involved in deep-seabed exploration up to that date, list their serious concerns that, in their opinion, still exist in the implementation of Part XI.

It would appear that most, if not all, of their concerns are unfounded. The points raised, however, highlight the rights contained in both LOSC and the Agreement.

Some of their concerns, in regard to the ISBA and its organs are as follows:

- a) *Fails to provide access to qualified privately financed miners.*<sup>1847</sup>

While decision making procedures are regarded as being improved, they feel that there are still too many obstacles for assured access by investors to mining rights.<sup>1848</sup> Rule-making processes must take place when a declaration of intent to commence the exploitation phase of a contract has been made. The Council is then required to complete the relevant rules within two years. If this is not possible the

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<sup>1842</sup> ibid

<sup>1843</sup> LOSC Article 76(8)

<sup>1844</sup> LOSC Article 8 Annex II

<sup>1845</sup> SPLOS n1801 n p22

<sup>1846</sup> "Entry into Force of the Law of the Sea Convention" Rhodes Papers MH Nordquist & JN Moore (eds) (1994) p76

<sup>1847</sup> ibid

<sup>1848</sup> ibid

approval of applications would be based on the provisions contained in LOSC. It would be possible, therefore, for States Parties to block the adoption of these rules and the mining operations of other licensees.<sup>1849</sup>

b) *Create a privileged class of investors for pioneers and discourage new entrants.*<sup>1850</sup>

The system of 'grand fathering' could possibly discriminate against new entrants in fields of deep-seabed mining. Some US officials disagree with this opinion. US licensed consortia will be granted similar, and no less favourable, rights to those already granted to Japanese, French, Russian, Chinese and India pioneer investors who have already registered claims with the Preparatory Commission.<sup>1851</sup>

c) *Permit the ISBA to impose unreasonable financial obligations on private investors.*<sup>1852</sup>

This is also considered by the US Department of State as being an overstatement. An annual fee of \$1 000 000, which was previously payable, is no longer applicable and only the application fee of \$250 000 is required.<sup>1853</sup>

d) *Impose training obligations on pioneer explorers at an unreasonable stage in their projects.*<sup>1854</sup>

There are no mandatory training obligations contained in the Agreement and those States, such as Japan, France and Russia, who have accepted training of this nature did so in exchange for being released from other obligations.<sup>1855</sup>

e) *Establish the ISBA, an untried international organisation with broad discretionary powers, the first with regulatory powers over a resource and taxing power over private persons, which will be partially controlled by States whose interests is to make seabed mining impossible.*<sup>1856</sup>

The concern that members of the Council may have different priorities to the mining conglomerates and therefore be able to frustrate legitimate applications is unfounded. The Legal and Technical Commission needs only a simple majority to recommend or not an application, Although Commission recommendations must be approved by the Council, with a two-thirds majority, great deference is given to technical commissions and the major developed States would have the opportunity of influencing Commission recommendations. It is considered, therefore, that the concern that seabed mining operations could be made impossible is unwarranted.

f) *Provide for decision-making mechanisms that will promote gridlock.*<sup>1857</sup>

These concerns are similar to those in e) above and are considered to be unfounded.

g) *Perpetuate the ideologically bankrupt concepts and policies of the so-called new international order.*<sup>1858</sup>

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<sup>1849</sup> Ibid

<sup>1850</sup> Ibid p77

<sup>1851</sup> Ibid

<sup>1852</sup> Ibid p78

<sup>1853</sup> Ibid

<sup>1854</sup> Ibid p79

<sup>1855</sup> Ibid

<sup>1856</sup> Ibid

<sup>1857</sup> Ibid p80

This is not necessarily correct. Third World voting rights have been replaced by special voting rights for specific economic interests. The Article in LOSC which details the composition, procedure and voting rights for the Council has been completely replaced in the Agreement<sup>1859</sup>

*h) Deprive investors of judicial and administrative due process.*<sup>1860</sup>

LOSC provides for all parties to an agreement to explore or exploit the deep seabed. Disputes may be settled before the Sea-Bed Disputes Chamber. This includes natural or juridical persons but they must, however, be sponsored by the State Party of which they are a national.<sup>1861</sup>

*i) Commit the United States to participation and implementation of the Convention regime and possibly major changes in the United States seabed mining law and program some years before the United States has decided to ratify the Convention.*<sup>1862</sup>

This is not correct. The Agreement has included an Article,<sup>1863</sup> Agreement Article 4, to provide for States to ratify both LOSC and the Agreement, depending on their circumstances.

*Provide for the creation of the "Enterprise", which would be a State mining company and operating arm of the Authority.*<sup>1864</sup>

The provisions to establish the Enterprise are contained in LOSC.<sup>1865</sup> The inclusion of this Article is to give substance to the concept of the Common Heritage of Mankind. The US Licensee's concerns are, to a certain extent, valid in that these provisions are still to be applied. The Agreement has, however, reformed the obligations on States Parties and they are no longer responsible for the financing of the Enterprise's first operation. In addition the Enterprise must now operate through joint ventures with other commercial enterprises. There is a requirement that in the future the Council must decide whether to base the Enterprise on commercial principals and whether commercial enterprises are required to provide the Enterprise with technology.<sup>1866</sup>

*j) Maintain the political and economic burdens to assist in the establishment of competitors through the so called "banking system" under which a miner must give a mine site equal to its own or half of its mine site to the Seabed Authority to be mined by the Enterprise.*<sup>1867</sup>

The Agreement retains the requirement for an applicant to make half of a site available to the Enterprise if the site is big enough, but the site need not be fully explored. In addition the applicant, that makes a site available to the Enterprise, has the option to enter into a joint venture in the exploitation of that site if it should so wish.<sup>1868</sup>

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<sup>1858</sup> *ibid*

<sup>1859</sup> LOSC Article 161(1), Agreement Annex Section 3 (15) &(16)

<sup>1860</sup> Nordquist n1826 p81

<sup>1861</sup> LOSC Articles 153(2)(b), 187(c), & Annex VI Article 37

<sup>1862</sup> Nordquist n1826 p81

<sup>1863</sup> *ibid* p82

<sup>1864</sup> LOSC Article 158(2)

<sup>1865</sup> *ibid*

<sup>1866</sup> Agreement Annex Sections 2 & 5

<sup>1867</sup> Nordquist n1826 p82

<sup>1868</sup> Agreement Annex Section 2(3) &(5)

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## **PART IV**

### **CONCLUSIONS AND ANALYSIS TABLES**

#### **CHAPTER XIII**

#### **CONCLUSIONS**

##### **THE DEVELOPMENT OF THE LAW OF THE SEA**

The interests of coastal States in the area seawards of their low-water line have traditionally been confined to security and the obvious benefits from fishing. The initial concern was, therefore, directed at establishing the extent to which a coastal State could claim sovereignty. Except for these early attempts at establishing territorial seas and passage and fishing rights in other areas the rest of the oceans and seas were regarded as "high seas". Fishing rights, both inside and outside territorial waters, were sometimes imposed by force as can be seen from the fisheries disputes in the North Sea and the English Channel. Coastal States have claimed various breadths for the territorial seas, but none were codified prior to 1982. The technical issue of the outer limit of the territorial sea was resolved, and simplified, by the choice of the range of the weaponry of the time the "cannon shot rule". No measurements were involved. This distance approximated 3nm at that time. It was obvious that at some stage compromises had to be made and international agreements entered into to exercise some form of control over the areas and interests in them.

The Geneva Conventions of 1958 were probably the most successful efforts to regulate many of these, and other, aspects up to that time. They failed, however, to finalise the breadth of the territorial sea. Efforts continued after the 1958 Conference to address the outstanding issues but failed to do so. It is not surprising therefore that the United Nations Law of the Sea Conference, that began in 1972, took ten years to complete LOSC. LOSC is a very comprehensive convention and covers many aspects that were not addressed before 1972. It contains 445 Articles on subjects such as boundary limits, navigation, marine scientific research, landlocked and geographically disadvantaged States, the harvesting and conservation of resources, pollution, and the administrative and legal institutions required to facilitate or control these activities.

For the first time the concept of the "Common Heritage of Mankind" was introduced into the debates and the rights, privileges and responsibilities of non-coastal States, landlocked and geographically disadvantaged, were considered. This did not introduce technical issues but it did require the coastal state to undertake research into the extent of the living resources within its exclusive economic zone to establish whether excess living resources existed that could be exploited by landlocked States in the region.

While an international tribunal or court is not necessarily obliged to follow precedent rulings and minority findings, rulings on technical issues, particularly aspects such as "natural prolongation" are taken into consideration. Judgements and the practice of States obviously had an influence on the drafting of LOSC and LOSC, with the exception of the mining of the deep seabed, generally reflects the thinking of both the courts and those involved in drafting LOSC. All legal cases, considered have been listed (Pages xiv-xv). Many are quoted and referred to in debates on law of the sea issues.

## **Status of LOSC**

LOSC came into force on 16 November 1994, one year after the 60<sup>th</sup> State Guyana ratified it. The UN General Assembly adopted the "Agreement on the Implementation of Part XI" on 28<sup>th</sup> July 1994. Part XI, which deals with the exploration and exploitation of the resources of the deep seabed beyond the exclusive economic zones or continental shelf claims of coastal States is largely concerned with the legal and financial issues of deep-seabed mining but the management, the use and the sharing of technical scientific research is included.

## **The Preparatory Commission for the International Seabed Authority and the International Tribunal for the Law of the Sea (Prepcom) (Resolutions I and II)**

The Prepcom came into being immediately after the Convention was signed and under the preparatory work for the International Seabed Authority and the International Tribunal for the Law of the Sea. It has now ceased to exist.

## **International Seabed Authority (Part XI Section 4) (ISBA)**

The ISBA with its various sub-organisations, such as the Assembly, the Enterprise, the Financial Committee and the Legal and Technical Committee have held meetings at the headquarters of the ISBA in Jamaica.

## **International Tribunal for the Law of the Sea (Annex VI)**

The International Tribunal for the law of the Sea has handed down judgement on the merits in the *Saiga* No2 case (St Vincent and the Grenadines v Guinea) on the 1<sup>st</sup> July 1999. (Judgement on provisional Measures was handed down in 1998 and a judgement in *Saiga* No1 case on prompt release was handed down in 1997).

## **Seabed Disputes Chamber and Arbitration and Special Arbitration Tribunals (Annex VI, VII, & VIII)**

The Chamber is in operation but will only have cases to consider when deep seabed mining licenses have been awarded. The subsidiary tribunals will only be formed as and when necessary.

## **Commission on the Limits of the Continental Shelf (CLCS) (Annex II)**

The Commission on the Limits of the Continental Shelf has drafted Guidelines for Coastal States wishing to lodge LOSC Continental Shelf claims with the Commission. It is difficult to visualise the effectiveness of the Commission when it is unable to impose a final time deadline on LOSC Continental Shelf claims that have been rejected by the CLCS for further consideration by the coastal State.

## **NATIONAL ZONES AND ACTIVITIES IN THEM**

The legal regimes of the various zones have been dealt with in earlier Chapters and the more important technical aspects related to these zones are commented on as follows:

- a) Internal waters are under the total sovereignty of the coastal State. LOSC does not detract from this sovereignty. As internal waters are inside baselines and closing lines the importance of straight baselines and bay closing lines is apparent as very little water can be found inside the normal baseline which is the low-water line.
- b) Territorial Waters are also under the sovereignty of the coastal State but the right of innocent passage has to be accepted by the coastal State in these waters. The passage must, however, be innocent and continuous.

The only concessions for a passage not being continuous would be in the case *force majeure* or where the vessel has gone to the aid of persons, ships or aircraft in danger or distress and for stopping or anchoring in the normal course of navigation. The importance of right of innocent passage from a non-legal point of view relates to the influence that this right could have over the exploration and the

exploitation activities being undertaken by the coastal State. Any offshore development project planning will have to take this aspect into consideration.

- c) In the contiguous zone there are additional rights in favour of a coastal State but no additional technical issues need be considered in this zone.
- d) In the exclusive economic zone the coastal State has the right to all natural resources of the sea and in, and on, the seabed. The coastal State controls all the exploration and exploitation of the resources, in this zone. To manage these resources it may be necessary to undertake additional research to ensure that they are being protected and this could involve regular research projects. The coastal state should also encourage and co-ordinate the research activities of its nationals, other States in the region, and international organisations in its maritime zones.

With the finalisation of the breadth of the territorial sea, the control of the resources in the waters off the coast of a State is probably the most important concept codified in LOSC. An exclusive economic zone is a major advantage to a coastal State. For the first time coastal States may exert control over the resources in these waters. The benefits of these zones, and in particular the exclusive economic zone, could be very significant, but a coastal State will require expert technical advice on how to claim the zones that are based on distances from the baselines of the state and how best to recover the resources from the sea and the seabed.

- e) Similar to the benefits to a coastal State from an exclusive economic zone, a claim to a LOSC Continental Shelf could be substantial. The concept of a LOSC Continental Shelf claim has been complicated by the poor use of confusing technical terminology. As discussed in earlier Chapters the use of the term "continental shelf" in LOSC is at great variance with the marine-geoscience definition. Care will have to be exercised by a coastal State in the application of the technical criteria contained in Articles 76 and 121. It is possible for a coastal state to maximise its claims in the confusion but the coastal State will have to undertake substantial research to justify such a claim and unless the technical justification can be produced the acceptance of a claim by the CLCS is debatable.

## FUNCTIONAL ASPECTS OF LOSC

As with the definition of the continental shelf the technical definitions contained in LOSC do not necessarily agree with the accepted international definitions used by the particular disciplines. Articles in some critical areas may be subject to different interpretations. In addition various organisations, constituted in accordance with the provisions of LOSC such as the CLCS, may draw up their own interpretations of some of the terms used in LOSC for their own purposes. These could include the foot-of-the-slope, oceanic islands and natural prolongation.

Various technical aspects have been considered in the previous Chapters and these are aspects that a coastal States should have a clear understanding of when considering the application and implications of LOSC. Since LOSC came into force there have also been technical and application developments in most spheres covered by LOSC which should also be investigated.

### Physical Features

Marine-geoscience aspects and geographical features are constantly used either as references for various criteria or are important aspects for general consideration. Geographical features such as banks, bays coastlines, deltas, harbour works, islands, natural entry points of bays, river mouths, straits, continental margins, sedimentation, beach dynamics, seamounts and guyots, and subsurface plateaux must be clearly understood and their positions accurately determined if they are to be of use during a delimitation process or in unilateral claims in the maritime zones.

Some of the more important aspects dealt with here are the following:

### **Baselines (Articles 3-10, 13-16, 35, 47-49, 57, 76, 82, 246)**

LOSC defines a number of different types of baselines from which the territorial sea and other maritime zones may be measured. The "normal" baseline is the low-water-line along the coast of a State as marked on large-scale charts. This does not include low-water-lines on structures built on permanently submerged features or on the seabed.

Straight baselines may replace the "normal" baseline providing certain criteria are met. It is also possible to draw a closing line across the natural entry points of a bay. The configuration of the coast and the position of the lowest tide should be available in map and, where necessary, in co-ordinate form to be able to ensure that the straight lines drawn are in accordance with LOSC. Specific areas may have to be resurveyed in greater detail and the best determination of the lowest astronomical tide (LAT) may be necessary, to obtain the best results. Baselines may not be drawn to low-tide-elevations unless a lighthouse or structure has been erected on it. One of the criteria used in the determination of the outer limits of a LOSC Continental Shelf, 350 nm from the baselines, is also obviously related to the baselines adopted by the coastal State. The practice of States in regard to the adoption of straight baselines has not always been in accordance with LOSC. A coastal State would be well advised to investigate State practice in this regard before promulgating its own straight baselines.

A number of the criteria for baselines are open to exploitation. The length of a straightline is not prescribed in LOSC and State Parties are not required to submit co-ordinates of the terminal of these straight baselines to the Secretary-General of the United Nations. As a result the predominant practice of States has not always been in accordance with the spirit of LOSC.

Archipelagic straight baselines may also be drawn by an archipelagic State around the outer islands of an archipelago provided that the ratio of land to water contained within the baselines is between 1:1 and 9:1. The terminals of these straight baselines should also be on the low-water line. The precise determination of the low-water-line is therefore important to the claims of an archipelagic State as well.

The closing line of a bay, which should also be from positions on the low-water-line, may also be used as a baseline from which the maritime zones can be measured.

### **Low-Water-Line (Articles 5, 7, 9 and 13)**

The low-water-line should theoretically be LAT, which usually occurs only every 18.61 years. In most instances, however, the gradient of the intertidal zone, or beach, are not usually of such a nature as to cause significant waterline movement seawards by a falling tide. In some areas, however, where the beach gradient is low and the falling tide recedes significantly seawards it is in the interests of the coastal State to determine precisely the position of the lowest tide.

Tidal observations in the area are therefore important and records should be of uninterrupted observations over the longest period of time possible. Where the beach gradient is steep it is probably adequate to determine the position of the low-water line from aerial photography flown at most stages of the tide. The low-water-line is a nebulous boundary, which is rarely evident. Although the differences between the various low-waters is usually insignificant the problem of determining a boundary, which only ever exists for a short period of time, is extremely difficult. It is perhaps advisable to establish rather the gradient of the inter-tidal zone and determine whether it is imperative to establish the lowest low-water-line.

### **Bays (Article 10)**

Bays are important in that they may be closed with closing lines from their natural-entry-points providing the bay meets the criteria contained in Article 10. This would create internal waters inside this line and the line would form the baseline from which maritime zones can be generated. The only way to establish whether a bay meets the criteria of LOSC is by obtaining maps or charts of the area at an adequate scale. This will give a general view of whether the bay should be surveyed in greater detail. The closing lines may incorporate islands situated in the mouth of the bay and part of the closing line could incorporate the low-water-line on the seaward side of these islands as part of the baseline. The only benefit in the use of the islands in bays, or in the mouth of a bay, would be that the summation of the straight lines joining the islands to the natural entry points of the bay, which should not be more than 24 nm, would not include the baselines on the islands. In addition the surface area of the islands, contained within the proposed closing lines, would be regarded as water area for calculation purposes.

### **Deltas (Article 7)**

Although most deltas will be found at the mouths of rivers some are found at the mouths of lagoons and estuaries. Some of the major river deltas are the Mississippi, the Ganges Brahmaputra and the Nile. Straight baselines may be drawn to the outer points of a delta. It is unusual for a lobe of a delta to recede without another lobe being formed but the baselines that are drawn on the delta, to the initial lobe, may be retained by the coastal State until they can be amended. Occasionally a new lobe is not formed. This occurred in the Nile Delta, which has suffered permanent regression as a result of the building of the Aswan Dam. These dams significantly reduced the amount of sediment delivered by the Nile River to the Nile Delta.

It is thought likely that the number of deltas that can drastically extend baselines seaward are few. It is necessary; however, to determine straight baselines on deltas, whether they are able to extend the maritime zones based on them or not, as the outer limits of the maritime zones would still have to be generated by them.

### **Reefs (Articles 6, 47)**

The low-water-lines on drying reefs may be included in the baselines of a coastal State. This includes the fringing reefs of islands and atolls. The right to use the low-water-lines on reefs as part of a series of straight baselines is not completely clear. Fringing reefs of atolls are relatively easy to identify, as the atoll is usually an isolated seabed feature. The ability to draw baselines to other reefs will depend on their relationship to the continent or island on which the coastal State is situated. This could prove difficult to establish.

### **Rock/Islands (Article 121)**

The most controversial definition is contained in LOSC Article 121. It concerns the definition of an island and the zones that it may generate. A rock, regardless of size, that is above high tide at all times is considered to be an island with at least a territorial sea. If it can also sustain human habitation or have an economic life of its own, it is entitled to all the maritime zones including a LOSC Continental Shelf. This is regarded as unacceptable in marine-geology terminology as it would be impossible for anything other than a continent or substantial island, such as Japan or New Zealand, to have a continental margin. This anomaly in the definitions makes it possible for coastal States to take advantage of LOSC to maximise claims. The ability of an island to sustain human habitation is a criterion that is theoretically possible to comply with by erecting a habitable structure on even the smallest rock and then to use the resources of the territorial sea which the rock would be entitled to claim regardless of whether it was inhabited or not. It is therefore possible for any rock, regardless of size to meet the requirements for it to generate all maritime zones, including a LOSC Continental Shelf. The importance of the provisions of LOSC in regard to the zones that they may generate is highlighted by the treatment of the two remaining portions of Okino Tori Island in the Japanese Archipelago and the expenses involved in their protection. They are only 20-30cm above the surface at

the highest tide but as they qualify as islands they generate territorial waters around them. They are being protected with concrete structures to avoid further erosion.

Article 121 has also created ambiguity in regard to what the LOSC Continental Shelf of some islands could be. As islands may have continental shelves, where would the foot-of-the-slope of an oceanic island be?

Also the determination of the foot-of-the-slope, which is defined in LOSC as being the point of maximum change in the gradient at the base of the slope, has proved difficult. If other geological and geographical factors are taken into consideration the position of the foot-of-the-slope could be determined in a very different position.

### **Continental Margins**

The definition of a continental margin is in agreement with the marine-geoscience definition of this submarine feature. Care should be taken however in the interpretation of Article 76 as normally a continental margin comprises a continental shelf, continental slope and the continental rise but in the case of the LOSC the LOSC Continental Shelf may incorporate the continental shelf, the continental slope, the continental rise and beyond the continental margin, even the deep seabed.

### **Sedimentation**

Article 76 makes provision for one of the outer limits of a LOSC Continental Shelf claim to be based on sediment thickness on the continental rise. The thickness of the sediment at a position must be equal to or greater than 1% of the distance of the position, where the thickness of the sediment was measured, to the foot of the continental slope. The composition and continuity of the rise is not specified so it is conceivable that while the sediment is relatively shallow inshore, a pocket of sediment at a substantial distance from the coast may give the necessary thickness.

## **APPLICATIONS OF FUNCTIONAL ASPECTS OF LOSC**

LOSC contains technical terms related to delimitation, survey, navigation, research and pollution, which may require careful consideration.

### **Delimitation**

Once it has been decided to determine the positions of baselines to delimit a boundary or to determine the outer limit of a LOSC Continental Shelf claim, it is recommended that a coastal State should first undertake a "desktop" survey to determine the technical requirements and the data needed for these determinations. Sophisticated equipment is now available for accurate surveys to be undertaken in the specific areas identified but could be expensive. The accurate positioning of baselines is fundamental to the delimitation of maritime boundaries and to the delineation of maritime zones.

### **Surveys**

The types of survey, that are necessary, vary

Information must be obtained by terrestrial or land surveying, hydrographic or bathymetric surveying, seismic surveying, and bottom sampling.

The availability of surveys of both the coastline and the seabed, adequate for boundary and zonal delimitation, is usually rare. Most of the research resulting in data held by Hydrographic offices, research institutions, and other coastal authorities and engineering organisations was undertaken for other purposes such as the production of charts for navigation, coastal zone management and research, and the exploitation of seabed resources. While the data is able to provide a reasonable reconnaissance record of the area, it is usually necessary to undertake specific surveys to obtain further necessary data. This would apply to baselines, boundaries between littoral or opposite States and the outer limits of the zones.

Where baselines, on which the outer limits of the maritime zones are based, have to be determined the coastal mapping available should be assessed as to whether it could be considered as adequate for the task and whether it is necessary for new surveys to be undertaken. It is also necessary to study the gradients in the intertidal zones.

To establish the position of either the low-water-line, as a normal baseline, or as the terminal points of straight baselines, the height of the low-water-line has to be determined from the tidal observations available. Accurate horizontal positioning of the low-water-line must then be undertaken, preferably related to a global ellipsoid such as WGS 84. If this is not possible, in the case of a lateral boundary or median line, the States concerned can agree to a locally adopted ellipsoid. The positioning of the lowest low-water-line is complicated as the position of LAT occurs only every 18.61 years. It is possible to survey positions that approximate LAT far more frequently. This is best and is most economically undertaken by aerial survey.

While the manner and results of the determination of the baselines of a coastal State, and therefore the extent of the zones based on them, are not prescribed in LOSC if international recognition of the baselines and the zones is to be achieved then the surveys should be to the highest standard and the results should comply with the provisions of LOSC. It is possible that some States may contest the legality of baselines or boundaries adopted by a State, on the grounds that they are not in accordance with LOSC.

Where lateral boundaries are being determined the coastal States involved must agree on a number of preliminary issues. These will include:

- a) the ellipsoid and the datum on which the geodetic computations are to be made,
- b) the type of boundary line, such as the equidistant line method,
- c) the geographical features that will affect the delimitation,
- d) the methods to be used in the surveys should also be agreed on.

Other factors that must be taken into consideration when the surveys are being undertaken are as follows:

- a) the positions of other geographical features such as islands, low tide elevations, the entry points of bays, the entry points of rivers, the 2500 metre isobath, and the foot of the continental shelf,
- b) the thickness of sediment on the continental rise, and
- c) the identification of the structure of the geological crusts. This may be necessary to substantiate aspects of a continental shelf claim.

The positions of above-surface features are also required by surveys and should be determined at times that are most advantageous to maximise the results.

Subsurface features are more difficult to survey but unless they are low-tide-elevations, the vertical component may not be as vital. The position of subsoil features will require seismic surveys that are usually more expensive when compared with hydrographic or terrestrial surveying.

A number of boundary options could be considered other than the traditional equidistant line. Lines of latitude, equidistant lines, lines of azimuth, and boundary lines based on agreed historical factors could be accepted. Finally, however, whatever is adopted, the boundary will have to be surveyed and

depicted in a manner that is understandable by those involved in the delimitation and by the national and international communities thereafter.

The outer limits of the continental shelf claimed by a coastal State have to be accepted by the CLCS. The Guidelines produced by the CLCS are meant to serve as advice to a State preparing a submission to the CLCS as to what the CLCS would consider favourably.

### **Ellipsoids, Datum and Projections**

When delimitations are based, wholly or partly, on existing surveys the relationship of the ellipsoids, and the datum used during these surveys is vital. It may be possible to easily transform the data from one ellipsoid and one set of datum to another but it may also be necessary to recompute some of the information. Failure to relate ellipsoids and datum could have a major influence on the positioning of features and boundary points in the delimitation calculations.

It is necessary to be able to view graphic representations of areas under consideration but it must be realised that it is difficult to depict accurately positions on the earth's surface on a map or chart. The positions of features, such as coastlines, low-water-lines or rocks islands and low-tide-elevations could vary according to the projection used and of the inability of the cartographer to represent a curved surface as a flat presentation. It is not possible to make decisions regarding boundary delimitation from lists of co-ordinates but after carefully geodetically computing the final positions and then by using the most suitable map projection the boundary and other positions can be plotted. It should be clear that the maps are purely to illustrate the calculations and calculations directly on the charts and maps should be avoided.

### **Navigation and Communication**

The traditional rights of innocent passage and freedom of navigation have been codified in LOSC. In addition the rights and privileges of the coastal State through whose waters these rights are being exercised have been defined by LOSC. There has been a marked increase in the rights of a coastal State in that it is now able to exert its jurisdiction beyond the 12 nm territorial sea for the protection of its environment and its resources. The fact that in the contiguous zone the coastal State may also control immigration, emigration, fiscal, sanitary and customs issues is an extension of some of its territorial rights. It should be borne in mind that not only does the coastal State have rights but it has obligations. These include the provision of maritime safety information and the requirement that coastal State activities, such as the laying of pipelines or the erection of structures on the seabed in all zones, except internal waters, should not interfere with the right of innocent passage and freedom of navigation or the safety of vessels.

In addition the depiction of any boundary has to be such that it is practical for any user. A boundary may subsequently be required for consideration should an international incident occur on, or in close proximity to, a boundary. The accuracy and the clarity of the public presentation of the boundary could be important for those involved in enforcement, for those operating commercially and for those in innocent passage or exercising freedom of navigation. With a clear demarcation of the maritime zones it is possible for the coastal State to legislate for the rights, privileges and obligations of both the coastal State and for other States and their nationals using these zones.

Archipelagic States are obligated to provide acceptable sea-lanes through their archipelagic waters. The selection of these sealanes requires careful hydrographic analysis and co-operation with international shipping and relevant international organisations. The initial selection of sealanes through the archipelagic waters of Indonesia has proved contentious and they have not yet been generally accepted.

### **Resources**

Coastal States have the rights to natural resources in the exclusive economic zone and on and in the seabed of a LOSC Continental Shelf. The resources that can be found in the zones are varied. They include the obvious types such as the many types of fish, gas, oil and other hydrocarbons. However the



sea and the seabed contain far more than the obvious, and mud, clays, oozes, manganese nodules, polymetallic sulphides, and energy sources are factors that should be considered. For a coastal State to be aware of these assets significant research has to be undertaken.

Many of the mineral resources found in the maritime zones are also found on land and the urgency for the exploitation of these resources is no longer a matter of priority. The existence and the extent of these resources is important to a coastal State to ensure their adequate protection is provided and their value is included in any future development plans of the coastal State.

### **Marine Scientific Research**

Research is necessary for the exploration, exploitation and protection of resources and the environment, particularly the environment in which the resources are found. The research will include bathymetry, oceanology, oceanography, marine geoscience and precise positioning accuracy. The determination of the existence and extent of resources could be expensive and the research to undertake and establish this information will have to be prioritised.

There is a duty on all States and international organisations conducting research in the zones of another State to make provision for the possible participation of the coastal State and to make the results of the research internationally available within an acceptable period of time. It will be difficult to control the activities of research vessels unless representatives of the coastal State are onboard the vessel during the period of the research. With modern technology, it is possible for a foreign vessel to undertake many different types of research without a coastal state being aware of it.

### **Pollution**

LOSC requires that a coastal State prevent, reduce and control pollution of the marine environment. Pollution is a major factor to be considered by a coastal State. In the past marine pollution has not been fully understood and many areas have been polluted and resources lost or damaged. Some of the pollution is as a result of activities within the coastal State or by the activities of others both inside or outside the territory of the State. This could be land-based pollution, dumping by both local and foreign parties, or pollution from the atmosphere. It is also possible, for pollution to occur from other sources such as activities on the seabed, from marine scientific research, and by the introduction of foreign species. Seabed mining could be a serious source of pollution and the types of mining and the manner of mining waste disposal should be carefully investigated and where possible the most advanced systems used.

Since maritime casualties are capable of being serious destructive occurrences of pollution, the importance of the provision of navigation information services by a coastal State in accordance with international conventions and the compliance of international shipping and international conventions, such as the SOLAS Convention is stressed.

While maritime casualties may cause serious pollution and damage to the environment and usually receive much publicity, the most persistent source of pollution of the marine environment is from land-based sources. It is difficult to prevent maritime casualties, pollution from vessels at sea, and from other activities at sea. Land-based pollution can be identified and the necessary steps taken to eliminate or reduce it. This could prove to be a difficult task and the advice of international organisations and experts may be necessary. The use of modern technology will greatly assist a coastal State in detecting and identifying both the pollutants and the source.

### **GENERAL**

It is evident that the technical issues contained in LOSC interrelate with the legal rights and responsibilities of the States Party and should be read in conjunction with one another when implementing the Articles of LOSC.

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GEODESY	GEOGRAPHY	GEOLOGY	SURVEY	DELIMITATION	NAVIGATION	RESOURCES	ORGANISATION	POLLUTION
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			X		X			
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## PART IX. ENCLOSED OR SEMI-ENCLOSED SEAS

## PART IX. ENCLOSED OR SEMI-ENCLOSED SEAS

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|  |   |   | X | DELIMITATION |
|  |   |   |   | NAVIGATION   |
|  | X |   |   | RESOURCES    |
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Article 202. Scientific and technical assistance to developing States . . . . .

Article 203. Preferential treatment for developing States . . . . .

Article 204. Monitoring of the risks or effects of pollution . . . . .

Article 205. Publication of reports . . . . .

Article 206. Assessment of potential effects of activities . . . . .

Article 207.	Pollution from land-based sources	.....
Article 208.	Pollution from sea-bed activities subject to national jurisdiction	.....
Article 209.	Pollution from activities in the Area	.....
Article 210.	Pollution by dumping	.....
Article 211.	Pollution from vessels	.....
Article 212.	Pollution from or through the atmosphere	.....

Article 213.	Enforcement with respect to pollution from land-based sources . . . . .
Article 214.	Enforcement with respect to pollution from sea-bed activities . . . . .
Article 215.	Enforcement with respect to pollution from activities in the Area . . . . .
Article 216.	Enforcement with respect to pollution by dumping . . . . .
Article 217.	Enforcement by flag States . . . . .
Article 218.	Enforcement by port States . . . . .
Article 219.	Measures relating to seaworthiness of vessels to avoid pollution . . . . .
Article 220.	Enforcement by coastal States . . . . .
Article 221.	Measures to avoid pollution arising from maritime casualties . . . . .
Article 222.	Enforcement with respect to pollution from or through the atmosphere . . . . .

Article 223.	Measures to facilitate proceedings	.....
Article 224.	Exercise of powers of enforcement	.....
Article 225.	Duty to avoid adverse consequences in the exercise of the powers of enforcement	.....
Article 226.	Investigation of foreign vessels	.....
Article 227.	Non-discrimination with respect to foreign vessels	.....
Article 228.	Suspension and restrictions on institution of proceedings	.....
Article 229.	Institution of civil proceedings	.....
Article 230.	Monetary penalties and the observance of recognised rights of the accused	.....
Article 231.	Notification to the flag State and other States concerned	.....
Article 232.	Liability of States arising from enforcement measures	.....
Article 233.	Safeguards with respect to straits used for international navigation	.....

Article 234. Ice-covered areas . . . . .

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## SECTION 10. SOVEREIGN IMMUNITY

## SECTION 11. OBLIGATIONS UNDER OTHER CONVENTIONS ON THE

Article 237. Obligations under other conventions on the protection and preservation of the marine environment . . . . .

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## SECTION 1. GENERAL PROVISIONS

## SECTION 1. GENERAL PROVISIONS

- | GEODESY | GEOGRAPHY | GEOLOGY | SURVEY | DELIMITATION | NAVIGATION | RESOURCES | ORGANIZATION | POLLUTION |
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